Modelling and Prediction of Financial Stock Investment in India

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Abstract

The paper focuses on predicting investments in stock markets in India. Stock market investment continues to be popular because it is liquid, and has the potential for high returns when the stock market is not overly volatile. In order to provide a realistic and safe advice for investors, this study forecasts what the India stock market index will look like over the next month. Stock market performance is easily measured with the help of stock market indices. First, the data on the stock market index has non-stationary properties and was differenced using the ADF (Augmented Dickey fuller) approach to regularize it. ARIMA model is fitted to the series and there are five tentative ARIMA models which include ARIMA (1,2,1), ARIMA (2,2,1), ARIMA (3,2,5), ARIMA(4,2,4) and ARIMA (5,2,1) where ARIMA (1,2,1) is the best selected model because it has the least AIC and SBIC, the highest adjusted R-square and the least volatility. The best fitted ARIMA (1,2,1) was then used to forecast, and the forecast was good as it is constant over the predicted period, and there is no evidence of high volatility cluster, which suggest to investors to go ahead with investment as there is possibility of making huge profit and having good returns.

Key words : Arima, Stock Market Index, Adf, Volatility, Investment.

1. Introduction

Stock investment is one of the most important and lucrative investments in India with the potential for a high profit. However, there is a high risk associated with investing in the stock market as the investment cannot be predicted. Investing is one of the fastest ways to earn money, and investing wisely can make a big difference. The same also likely goes for financial stock and why that's important. It is important to note that when using the stock market index, the data should be verified and any inconsistencies noted. The Stock market is a great indicator of the financial stock's performance. The stock market is expected to have a positive growth; this indicates that there is no increase of high volatility. Investing in the stock market can either lead to success or failure; therefore, it should be treated with extra care to prevent loss.

1.1 Research Gap

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Stock market investing is as lucrative as oil business, but comes with considerably higher risk. Investment in the stock market is not predictable because there is a high chance of making a profit or going bankrupt. Therefore, it is necessary to study market trends in order to know whether it is bluish or bearish. We also see that financial stock market with less volatility may bring in great security, profits and good returns. As an investor it is not advisable to invest in a stock market that is highly volatile so there is a need to study the trend and know the appropriate period suitable to invest on stock market.

1.2 Research Objectives

- To fit appropriate models to stock market index
- To study the trend of the stock market performance
- To forecast for future stock market index
- To make useful recommendation to the investors.

1.3 Research questions

Is the India stock market advisable to invest on based on the performance of the period under review?

Do we have a highly volatile stock?

Can we possibly make a good return in India financial stock investment?

2. Literature Review

The first stock market being established in China in 1872 is followed by Indian trading floors in 1875.

Since 1960, the stock exchange has opened. More than twenty-four stock exchanges operate in the country today. All were from different regions, i.e. the West, Midwest, and Pacific West. In the midst of free market globalization, a plethora of new entities were formed including the stock exchange and the over-the-counter market (Lasker, 2019).

The value of a stock and the stock market are both driven by the popularity of the stock and its price will likely be driven by the market. The stock market is a crucial part of America's economy and is essential to capitalism (Banz, 1981)

The board of directors oversees trades and decisions are made with the assistance of the staff. The Ministry of Finance manages and enforces the economy. In response to the adoption of the Securities Act, the SEC was established to regulate the development and improvement of the securities industry (National stock exchange, 2018).

Companies have varying levels of stock holdings in the market. Through capital markets, investors have the ability to make investments at the most opportune times. The stock market helps businesses raise capital because it allows them to offer stock for sale. It is widely required in modern business, as well as various governmental structures. There is a calculator dedicated solely to helping business members thrive. The gold market is an integral part of the system of money and an indispensable player in the international financial system. Marketplaces such as the stock market allow companies to create wealth by introducing new products (Jalan, 2010). The Gross Domestic Product is one of many economic metrics that provides an indication of how the economy is doing. The health of the economy is affected by the state of the economy (Basu, 1977). To be successful, it is necessary to deal with a broker/brokerage when purchasing and selling stocks and bonds (NSE, 2002). Stock trades are completed

online. Those on the Bombay Stock Exchange, which is the largest listed company, are larger companies. The majority of trading on the Indian stock market occurs at the Bombay Stock Exchange and National Stock Exchange. The origin of the disease was traced to the 1700s. The organization was founded in 1992 and is still thriving after 20 years. The markets are subject to the same rules and the same time constraints as other trades.

As of February 2020, the BSE had about 5,500 listed firms whereas the NSE had about 1,800 (having been in existence only a short time as of December 31. In the Dow Jones Index, the most of the 500 firms are the ones who carry the majority of the market cap. The rest of the market is quite small, consisting of stock firms that are readily tradable. Like big companies in America, India's companies are traded on both stock exchanges. The "BSE", or BSE Stock Exchange, is the older stock market exchange. The "NSE", or National Stock Exchange, is also known as the NSE, or National Stock Exchange, and is the largest stock market exchange, in terms of volume. In this situation, the liquidity of the NSE is more apparent. Both companies have more than $2.3 trillion in market cap. Both exchanges will bring forth the opportunity for the market to have efficiency and economic growth. The exchange prices will be competitive within itself because of the competition that it has arisen from arbitrageurs/price-fixers (World bank, 2018).

Like big companies in America, India's companies are traded on both stock exchanges. The Old Stock Exchange is the older stock market exchange, while the New Stock Exchange is the largest stock market exchange in terms of volume. And all of this makes the NSE a more liquid market than the NASDAQ. Both companies have more than $2.3 trillion in market cap. Both exchanges will bring forth the opportunity for the market to have efficiency and economic growth. The fact that there is presence of arbitrageurs on both the stock exchange keeps the prices of the stocks within a very tight range, and causes the prices of the stocks from deviating only slightly from fair value. If the economy were to be broken down, the companies as well as the smaller players would make up the Indian economy. S&P BSE SENSEX publishes every single trading day the financial information of the Indian stock market. The SENSEX index was at 100 in the previous year. Since 2008, the government has been using the DOLLEX-30 bond to deal with the economy crisis.

In 2015, the market cap of the Indian stock market shifted.

Few people expected that stocks would increase so strongly in a healthy economy, hurting the marijuana industry. Foreign investors ignored the fact that India fell short last year, hoping to invest in the future (Thakral, 2018).

There is a covid-19 virus that is killing people, and efforts are underway to curb its growth. The global economy is once again in the black and stock markets such as the Bombay Stock Exchange are also increasing their growth (National stock exchange, 2020).

The Indian investment environment is diverse and competitive, as compared to what is seen elsewhere (Arun, 2018).

3. Methodology

The statistical methods adopted for this research are augmented Dickey fuller for differencing the variable and ARIMA for appropriate modelling (Swain,2018). ARIMA is denoted with autoregressive integrated moving average. It is written as ARIMA (p,d,q)

and it is divided into meaningful components known as AR(P), dand MA (q) where AR is the autoregressive terms denoted with q, d is the non-seasonal differencing that makes your series or variable stationary (or simply called integration) and we said a series is integrated of order 1 when it is differenced once, that is I(1) or integrated of order 2 when it is differenced twice, that is I(2) while Ma is known as moving average (Asterious and Hall, 2011). And for the ARIMA forecasting system, forecast variables are regressed on lags of the forecast variable, as well as errors. This make ARIMA, a good forecasting statistical tool (Box and George, 2015).

4. Data analysis and Interpretation

The data for this work was collected from the online extract of tradingeconomics.com/India/Stock-market over a period of last 66 days stock market index (SENSEX) report so as to observed the study performance within that period in India. The Statistical software used for this study analysis is EViews version 10.0.

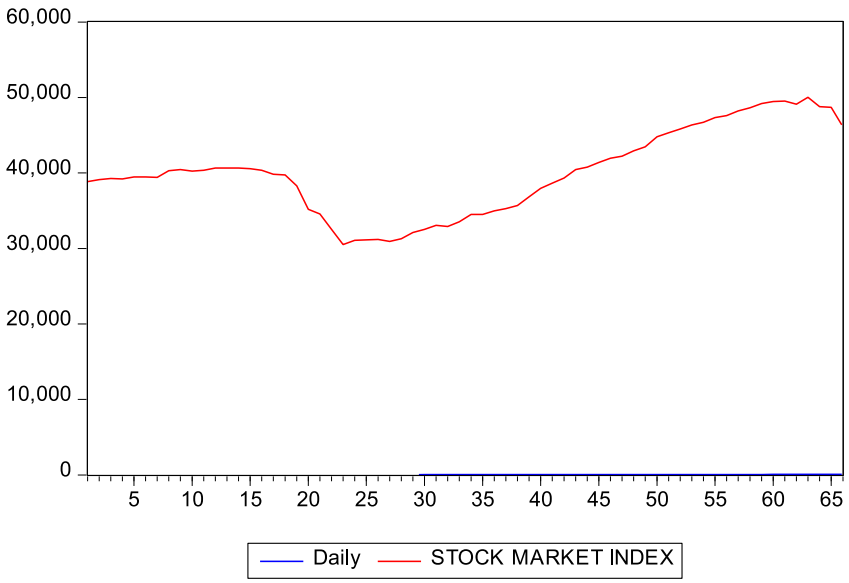
4.1 Descriptive Analysis

Table 1

	STOCKMARKETINDEX
Mean	40032.37
Median	40025.06
Maximum	50018.80
Minimum	30513.78
Std. Dev.	5681.809
Skewness	0.097290
Kurtosis	2.052189
Jarque-Bera	2.574569
Probability	0.276019
Sum	2642137.
Sum Sq. Dev.	2.10E+09
Observations	66

The above descriptive statistics shows that P=0.276019>0.05 significant level using Jarque-Bera and this implies that the data is normally distributed. The skewness is positively skewed which means that the mean is at the right-hand side of the median.

Graph 1



The above graph simply tells us that stock market index is non stationary and is not constant within the period under review but tend to fluctuates and this agree with the fact that the stock market is not predictable and there is need to study the trend well before investing in it.

Table 2

Null Hypothesis: D(STOCK_MARKET_INDEX,2) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=10)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-12.86260	0.0000
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(STOCK_MARKET_INDEX,3)

Method: Least Squares

Date: 01/29/21 Time: 16:21

Sample (adjusted): 4 66

Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(STOCK_MARKET_INDEX(-1),2)	-1.543041	0.119963	-12.86260	0.0000
C	-46.73065	91.74532	-0.509352	0.6123
R-squared	0.730621	Mean dependent var		-38.2901

			9
		S.D. dependent	1391.65
Adjusted R-squared	0.726205	var	0
		Akaike info	16.0502
S.E. of regression	728.1873	criterion	2
	3234565		16.1182
Sum squared resid	8	Schwarz criterion	6
	-	Hannan-Quinn	16.0769
Log likelihood	503.5821	criter.	8
		Durbin-Watson	2.14528
F-statistic	165.4466	stat	8
Prob(F-statistic)	0.000000		

The above output is the result of the differenced series using Augmented Dickey Fuller (ADF) so as to make the stock market index stationary. We can see that P=0.000<0.01 which tells us that the series is stationary after being integrated of order 2 and therefore becomes stationary. This satisfy the time series assumption that series should be stationary.

Table 3

TABLE FOR SELECTING THE BEST FITTED ARIMA MODEL

Differenced Stock Market Index	ARIMA (1,2,1)	ARIMA (2,2,1)	ARIMA (3,2,5)	ARIMA (4,2,4)	ARIMA (5,2,1)
Significant coefficients	3	3	3	3	1
$Sigma^2$(volatility)	591067.7	682803.4	3056168	4056767	2618806
Adj.R^2	0.9805	0.9774	0.8992	0.8662	0.9136
AIC	16.31	16.58	17.98	18.32	17.91
SBIC	16.44	16.50	18.11	18.44	18.04

We can see from the above table that ARIMA (1,2,1) is the best selected model based on the following criteria's;

ARIMA (1,2,1) has the lowest AIC and SBIC

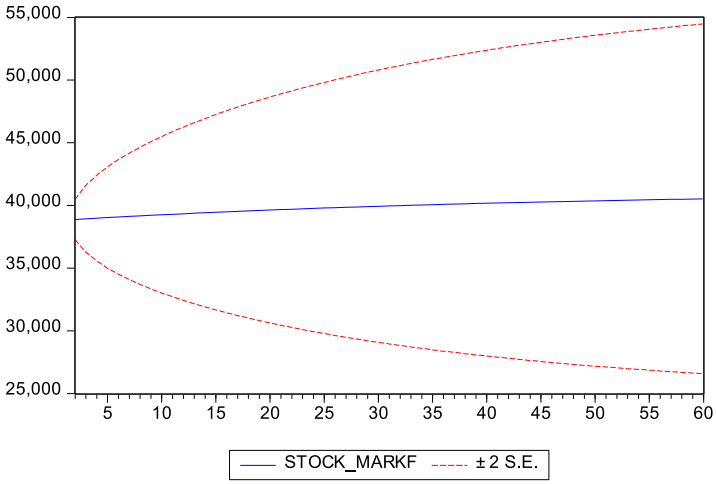
ARIMA (1,2,1) has the highest adjusted R-square

ARIMA (1,2,1) has the lowest volatility.

On the basis of the above selection criteria ARIMA (1,2,1) is the best fitted model when compared to the other tentative models. Hence there is a need to forecast with the ARIMA (1,2,1).

Graph 2

Forecast of the ARIMA (1,2,1) For the next 60 days.



Forecast: STOCK_MARKF	
Actual: STOCK_MARKET_INDEX	
Forecast sample: 1 60	
Adjusted sample: 2 60	
Included observations: 59	
Root Mean Squared Error	5095.954
Mean Absolute Error	4034.615
Mean Abs. Percent Error	10.84423
Theil Inequality Coefficient	0.064189
Bias Proportion	0.019124
Variance Proportion	0.857404
Covariance Proportion	0.123472
Theil U2 Coefficient	6.727878
Symmetric MAPE	10.37135

The above shows the next 60 days forecast of stock market index using ARIMA (1,2,1) being the best selected model. We can see that the forecasted values fall between the two 95% confidence interval and the forecast is constant over the period of 60days and this simply means that the forecast is good and there is no evidence of volatility clustering. So, the investor can invest in this stock because it is not volatile.

5.0 Conclusion

This study uses financial modeling and data from India to predict stock investment activity. Investments in securities are very competitive and profitable, but are also associated with high risk since the market is not predictable. The stock market index is a viable tools for assessing the performance of the financial stock market and for the purpose of this study, the market index was model using ARIMA and there are five tentative models in which ARIMA (1,2,1) is selected as the best fitted model based on the adequate selection criteria adopted. The model was a good fit for the data and this led to the model assumptions being correct. Based on the current forecast, it is recommended that investors go into the stock market because it is unlikely to have a high degree of volatility and has the potential for good returns.

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ARIMA (1,2,1)

Dependent Variable: STOCK_MARKET_INDEX

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 01/29/21 Time: 16:14

Sample: 1 66

Included observations: 66

Convergence achieved after 21 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41138.87	6557.378	6.273677	0.0000

AR(1)	0.977832	0.021917	44.61449	0.0000
MA(1)	0.340804	0.092844	3.670702	0.0005
SIGMASQ	591067.7	80899.13	7.306231	0.0000

		Mean dependent	40032.37
R-squared	0.981409	var	
Adjusted R-squared	0.980510	S.D. dependent var	5681.809
		Akaike info criterion	16.30674
S.E. of regression	793.2220		
Sum squared resid	13901046		16.43945
		Schwarz criterion	
	-	Hannan-Quinn	16.35918
Log likelihood	534.1225	criter.	
		Durbin-Watson	1.585472
F-statistic	1091.003	stat	
Prob(F-statistic)	0.000000		

Inverted AR	
Roots	.98
Inverted MA	
Roots	-.34

Dependent Variable: STOCK_MARKET_INDEX

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 01/29/21 Time: 16:15

Sample: 1 66

Included observations: 66

Failure to improve objective (non-zero gradients) after 52 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41627.38	6190.156	6.724772	0.0000
AR(2)	0.968930	0.041720	23.22449	0.0000
MA(1)	0.999999	215.8353	0.004633	0.9963
SIGMASQ	682803.4	3999167.	0.170736	0.8650

R-squared	0.978524	Mean dependent var	40032.37
Adjusted R-squared	0.977485	S.D. dependent var	5681.809
S.E. of regression	852.5581	Akaike info criterion	16.45216
Sum squared resid	45065028	Schwarz criterion	16.58487
Log likelihood	-538.9212	Hannan-Quinn criter.	16.50460

		Durbin-Watson stat	0.960673
F-statistic	941.6486		
Prob(F-statistic)	0.000000		

Inverted AR Roots	.98	-.98
Inverted MA Roots	-1.00	

Dependent Variable: STOCK_MARKET_INDEX

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 01/29/21 Time: 16:16

Sample: 1 66

Included observations: 66

Convergence achieved after 12 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41314.57	3721.104	11.10277	0.0000
AR(3)	0.896685	0.073422	12.21275	0.0000

MA(5)	0.452584	0.218691	2.069515	0.0427
SIGMASQ	3056168.	523831.1	5.834263	0.0000

		Mean dependent	40032.37
R-squared	0.903875	var	
Adjusted R-squared	0.899224	S.D. dependent var	5681.809
		Akaike info criterion	17.98480
S.E. of regression	1803.702		
Sum squared resid	2.02E+08	Schwarz criterion	18.11750
		Hannan-Quinn criter.	18.03724
Log likelihood	-589.4983		
		Durbin-Watson stat	0.241708
F-statistic	194.3320		
Prob(F-statistic)	0.000000		

Inverted AR Roots	.96	.48+.84i	-.48-.84i	
Inverted MA Roots	.69-.50i	.69+.50i -.85	-.26+.81i	-.26-.81i

Dependent Variable: STOCK_MARKET_INDEX

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 01/29/21 Time: 16:17

Sample: 1 66

Included observations: 66

Convergence achieved after 16 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41362.46	3052.287	13.55130	0.0000
AR(4)	0.838734	0.110099	7.617977	0.0000
MA(4)	0.554344	0.192803	2.875185	0.0055
SIGMASQ	4056767.	586966.2	6.911414	0.0000

R-squared	0.872404	Mean dependent var	40032.37
Adjusted R-squared	0.866230	S.D. dependent var	5681.809
S.E. of regression	2078.099	Akaike info criterion	18.31719
Sum squared resid	2.68E+08	Schwarz criterion	18.44990
Log likelihood	-600.4674	Hannan-Quinn criter.	18.36963
F-statistic	141.3028	Durbin-Watson	0.307203

	stat	6	
Prob(F-statistic)	0.000000		
Inverted AR Roots	.96	.96i	.00-.96i
Inverted MA Roots	.61+.61i	1i	.61-.61i

Dependent Variable: STOCK_MARKET_INDEX

Method: ARMA Maximum Likelihood (OPG - BHHH)

Date: 01/29/21 Time: 16:19

Sample: 1 66

Included observations: 66

Failure to improve objective (non-zero gradients) after 27 iterations

Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41425.27	2648.315	15.64212	0.0000
AR(5)	0.827882	0.099048	8.358372	0.0000

MA(1)	0.999997	1469.773	0.000680	0.9995
SIGMASQ	2618806.	1.39E+08	0.018797	0.9851

		Mean dependent var	40032.37
R-squared	0.917632		
Adjusted R-squared	0.913646	S.D. dependent var	5681.809
S.E. of regression	1669.659	Akaike info criterion	17.90585
Sum squared resid	1.73E+08	Schwarz criterion	18.03855
Log likelihood	-586.8930	Hannan-Quinn criter.	17.95829
F-statistic	230.2386	Durbin-Watson stat	0.457009
Prob(F-statistic)	0.000000		

Inverted AR Roots	.96	.92i	.30-.92i	.30+.92i	-.78-.57i
	-.78+.57i				
Inverted MA Roots	-1.00				