

A Study on Analysing the Impact of Rate of Interest and Rate of Inflation on Bombay Stock Exchange (BSE)

*** Dr. L.J. Charlas**

**** Ms. J. Lydia**

* Head and Research Advisor in Commerce, St. Joseph's College (Autonomous),
Tiruchirappalli

** Assistant Professor in Commerce, Bishop Heber College (Autonomous), Tiruchirappalli

Abstract

The movement of stock indices is highly sensitive to the changes in fundamentals of the economy and to the changes in expectations about future prospects. Expectations are influenced by the micro and macro fundamentals, which may be formed either rationally or adaptively on economic fundamentals, as well as by many subjective factors which are unpredictable and also non quantifiable. It is assumed that domestic economic fundamentals play determining role in the performance of stock market. The common external factors influencing the stock return would be stock prices in global economy, the interest rate and the exchange rate. The purpose of this paper is to study the impact of macroeconomic factors on BSE SENSEX. Macro economic climate here is comprised of Rate of Inflation and Rate of Interest. Data relating to the factors is collected from www.rbi.org and www.bseindia.com.

Keywords: *Macro economic variables, BSE Sensex, Global economy, Stock prices, stock return.*

Introduction

Indian capital market since liberalizations has undergone tremendous changes and has evolved as a vibrant system of investment flows. A dynamic capital market is an important segment of the financial system of any country as it plays a significant role in mobilizing savings and channeling them for productive purposes. The efficient fund allocation depends on the stock market efficiency in pricing the different securities traded in it. Macroeconomic variables are the element of a factor (variable) which is independent of the level of income. (E.g. the level of consumption that people need to survive even when they have no income)

Stock markets are said to reflect the health of the country's economy. On the other hand, major economic indicators determine stock market movements to a large extent. From a thorough analysis of the various economic indicators and its implications on the stock markets, it is observed that stock market movements are largely influenced by broad money supply, inflation, credit / deposit ratio and fiscal deficit apart from political instability.

Stock market volatility has been a major cause of concern for policy makers, investors and academia throughout the world, especially for the last two decades. Rapid financial innovations, regulatory and non-regulatory reforms, SEBI interventions, globalization of Indian capital market, new classes of investors, etc. have all shown a great impact on the behavior of share prices in India. Together, the new participants and the new market environment have impacted the market structure which in return resulted in high volatility.

The market volatility has been impacted by various factors like the macro economic variables, operations of Foreign and Domestic Institutional Investors, derivatives market operations as well as the international stock market operations.

Review of Related Literature

A Paper titled on (2011), “**The impact of Macroeconomic Fundamentals on Stock Prices revisited: An Evidence from Indian Data**” by **Pramod Kumar Naik & Puja Padhi** investigated the relationships between the Indian stock market index (BSE Sensex) and five macroeconomic variables. The analysis reveals that macroeconomic variables and the stock market index are co-integrated and, hence, a long-run equilibrium relationship exists between them¹.

A study titled on (2013), “**Effect of select macroeconomic variables on stock returns in India**” by **P. Bhanusireesha** examined the impact of select macroeconomic variables on stock, gold and silver returns by using linear regression technique. The behavior of nominal and real returns at various levels of inflation, GDP, IIP and Money Supply is studied. The interdependence of the returns on stock, gold and silver is also identified².

A paper titled on “**Impact of Macro-Economic Variables on Stock Prices in India**” by **Gagan Deep Sharma and Mandeep Mahendru** analyzed the relationship among these factors. Results reveal that there is high correlation between the empirical results reveal that exchange rate and gold prices highly affect the stock prices on the other hand the influence of foreign exchange reserves and Inflation on the stock price is upto limited extend only³.

Objectives of the Study

The following are the objectives of the study;

1. To study the impact of domestic macroeconomic fundamentals on BSE SENSEX
2. To analyse the relationship between BSE SENSEX and the macroeconomic behavior of the variables like Interest rate, Inflation rate

Hypotheses of the Study

The following are the null hypotheses of the study;

1. There is no significant relationship between BSE SENSEX and Inflation Rate
2. There is no significant relationship between BSE SENSEX and Interest Rate

Methodology of Study

a) Universe of the Study

The effect of all the macroeconomic variables on Bombay Stock Exchange is the universe of the study.

b) Sample of the Study

Interest rate and Inflation rate were taken as the sample of the study.

c) Types and Sources of Data

The present study purely based on secondary data. The required data for analysis have been collected from following website (www.rbi.org, www.bseindia.com)

d) Period of the Study

The study covers the period of two years from 1st January 2012- 31st December 2014.

e) Statistical Tools to be Used

- i. Descriptive statistics
- ii. Augmented Dickey Fuller Test (ADF)
- iii. Autocorrelation
- iv. ARCH/GARCH

I. Analyses of the Descriptive Statistics of BSE Sensex, Inflation Rate and Interest Rate

1. Analysis of Descriptive Statistics of BSE SENSEX and INFLATION RATE from 01.01.2012 to 31.12.2014

Table - I.1

Results of Descriptive Statistics of BSE SENSEX and INFLATION RATE from 01.01.2012 to 31.12.2014

Particulars	BSE SENSEX	Inflation Rate
Number of Observation	36	36
Mean	20670.39	0.702222
Maximum	28142.15	2.440000
Minimum	16357.57	-1.650000
Standard Deviation	3405.176	0.741763
Skewness	0.868979	-0.516059
Kurtosis	2.599364	5.129326

Source: Computed From: E-views Software

Interpretation

The results of Descriptive statistics of BSE SENSEX and inflation rate were shown in the Table – I.1. The mean of BSE SENSEX and Inflation Rates were 20670.39 and 0.702222. The Maximum return earned by the BSE SENSEX and inflation rate was 28142.15 and 2.440000. The Minimum return earned by the BSE SENSEX and inflation rate was 16357.57 and -1.650000. The standard deviation of BSE SENSEX and inflation rate was 3405.176 and 0.741763. The Skewness of BSE SENSEX was 0.868979 and inflation rate was -0.516059. It means that the BSE SENSEX was positively skewed and the inflation rate was negatively skewed. The value of kurtosis indicates the levels of risk deviation. The Kurtosis of BSE SENSEX and inflation rate was 2.599364 and 5.129326 respectively. Hence, the BSE SENSEX Kurtosis was platykurtic and inflation rate was leptokurtic. The overall analysis of descriptive statistics of Inflation rate has less impact on BSE SENSEX.

2. Analysis of Descriptive Statistics of BSE SENSEX and INTEREST RATE from 01.01.2012 to 31.12.2014

Table – I.2

Results of Descriptive Statistics of BSE SENSEX and INTEREST RATE from 01.01.2012 to 31.12.2014

Particulars	BSE SENSEX	Interest Rate
Number of Observation	36	36
Mean	20670.39	8.895833
Maximum	28142.15	10.25000
Minimum	16357.57	6.000000
Standard Deviation	3405.176	0.663796
Skewness	0.868979	-1.984447
Kurtosis	2.599364	11.88121

Source: Computed From: E-views Software

Interpretation

The results of Descriptive statistics of BSE SENSEX and interest rate were shown in the Table – I.2. The mean of BSE SENSEX and interest rates were 20670.39 and 8.895833. The Maximum return earned by the BSE SENSEX and interest rate was 28142.15 and 10.25000. The Minimum return earned by the BSE and interest rate was 16357.57 and 6.000000. The standard deviation of BSE SENSEX and interest rate was 3405.176 and 0.663796. The skewness of BSE SENSEX was 0.868979 and interest rate was -1.984447. It means that the BSE SENSEX was positively skewed and the interest rate was negatively skewed. The value of kurtosis indicates the levels of risk deviation. The Kurtosis of BSE SENSEX and interest rate was 2.599364 and 11.88121 respectively. Hence, the BSE SENSEX Kurtosis was platykurtic and interest rate was leptokurtic. The overall analysis of descriptive statistics of Inflation rate has less impact on BSE SENSEX.

II. Analysis of Augmented Dickey Fuller (ADF) Test of Daily Prices Returns of BSE Sensex, Inflation Rate and Interest Rate

1. Analysis of Augmented Dickey-Fuller Test of BSE SENSEX and INFLATION RATE from 01.01.2012 to 31.12.2014

Table - II.1

Results of Augmented Dickey-Fuller Test of BSE SENSEX and INFLATION RATE from 01.01.2012 to 31.12.2014

Period of Trade	Prices	Level	
		T-Statistics	Probability
1 st January 2012 to 31 st December 2014	BSE SENSEX	-3.206431	0.000002
	Inflation Rate	-7.529051	0.000000
Test Critical Value	1% Level	-3.6422	
	5% Level	-2.9527	
	10%Level	-2.6148	
Durbin Watson statistics	BSE SENSEX	1.934080	
	Inflation rate	1.730150	

Source: Computed From: E-views Software

Interpretation

ADF test was performed to check the stationarity of the time series. The results were shown in Table – II.1. ADF statistics of the inflation rate was -7.529051, fall behind the critical values even at 1% significance level (-3.6422) (thus, giving probability values 0.000000); ADF statistics of the BSE SENSEX was -3.206431 fall behind the critical value only at 5% significant level (-2.9527) (thus, giving probability values 0.000002) thereby, leading to the rejection of the hypothesis of unit root for both the series. It may be noted that as a consequence of stationarity at level form (1% and 5%) in both the series. With the help of Durbin Watson statistics, the series of BSE SENSEX (1.934080) and inflation rate (1.730150) were stationarity, which is nearer to 2. Hence, it can be safely concluded based on ADF test statistics that BSE SENSEX as well as inflation rate are found to be stationarity at level form.

2. Analysis of Augmented Dickey-Fuller Test of BSE SENSEX and INTEREST RATE from 01.01.2012 to 31.12.2014

Table - II.2

Results of Augmented Dickey-Fuller Test of BSE SENSEX and INTEREST RATE from 01.01.2012 to 31.12.2014

Period of Trade	Prices	Level	
		T-Statistics	Probability
1 st January 2012 to 31 st December 2014	BSE SENSEX	-3.206431	0.000002
	Interest Rate	-6.011978	0.000003
Test Critical Value	1% Level	-3.6422	
	5% Level	-2.9527	
	10%Level	-2.6148	
Durbin Watson statistics	BSE SENSEX	1.934080	
	Interest Rate	2.127162	

Source: Computed From: E-views Software

Interpretation

ADF test was performed to check the stationarity of the time series. The results are shown in Table – II.2. ADF statistics of the interest rate was -6.011978, fall behind the critical values even at 1% significance level (-3.6422) (thus, giving probability values 0.000003); ADF statistics of the BSE SENSEX was -3.206431 fall behind the critical value only at 5% significant level (-2.9527) (thus, giving probability values 0.000002) thereby, leading to the rejection of the hypothesis of unit root for both the series. It may be noted that as a consequence of stationarity at level form (1% and 5%) in both the series. The Durbin Watson statistics of BSE SENSEX (1.934080) and inflation rate (2.127162) were stationarity which is nearer to 2. Hence, it can be safely concluded based on ADF test statistics that BSE SENSEX as well as inflation rate are, both, found to be stationarity at level form.

III. Analysis of Correllogram

Table – III 1(a)

Results of Autocorrelations of BSE SENSEX

Series: avg

Lag	Autocorrelation	Std. Error ^a	Box-Ljung Statistic		
			Value	Df	Sig. ^b
1	.892	.160	31.083	1	.000
2	.789	.158	56.123	2	.000
3	.690	.155	75.886	3	.000
4	.584	.153	90.455	4	.000
5	.476	.151	100.439	5	.000
6	.365	.148	106.500	6	.000
7	.256	.146	109.594	7	.000
8	.177	.143	111.116	8	.000
9	.113	.140	111.768	9	.000
10	.071	.138	112.031	10	.000
11	.043	.135	112.134	11	.000
12	.008	.132	112.138	12	.000
13	-.021	.130	112.164	13	.000
14	-.051	.127	112.324	14	.000
15	-.083	.124	112.778	15	.000
16	-.108	.121	113.582	16	.000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation

Table - III.1(b)
Results of Partial Autocorrelations of
BSE SENSEX

Series:avg

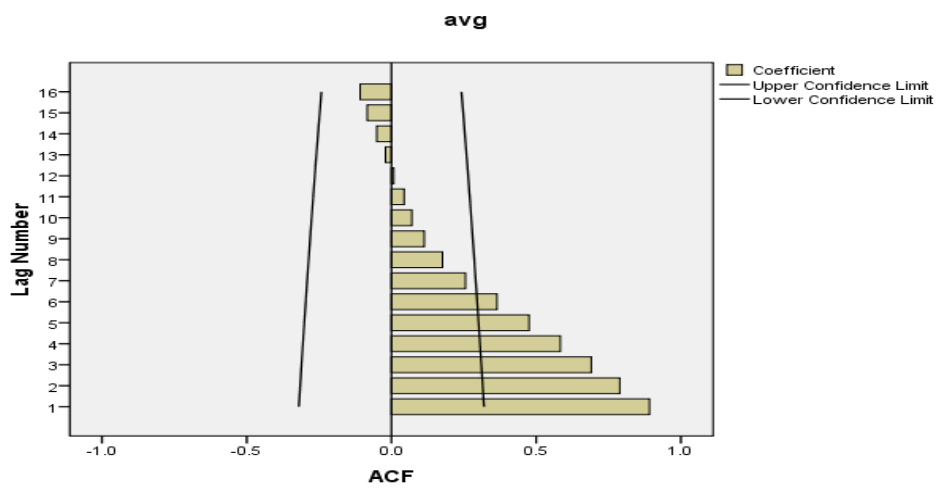
Lag	Partial Autocorrelation	Std. Error
1	.892	.167
2	-.031	.167
3	-.035	.167
4	-.098	.167
5	-.076	.167
6	-.090	.167
7	-.068	.167
8	.059	.167
9	.022	.167
10	.050	.167
11	.026	.167
12	-.085	.167
13	-.038	.167
14	-.069	.167
15	-.054	.167
16	.000	.167

Source: Computed from SPSS Software

Interpretation

Initially residuals are gray noise. So that there is a significant pattern left in the time series. After these, significant spikes of ACF or PACF's as shown above tables 4.5. Which indicate that there are no significant spikes of ACF or PACF's of residual are white noise throughout the study period.

Figure



Figure

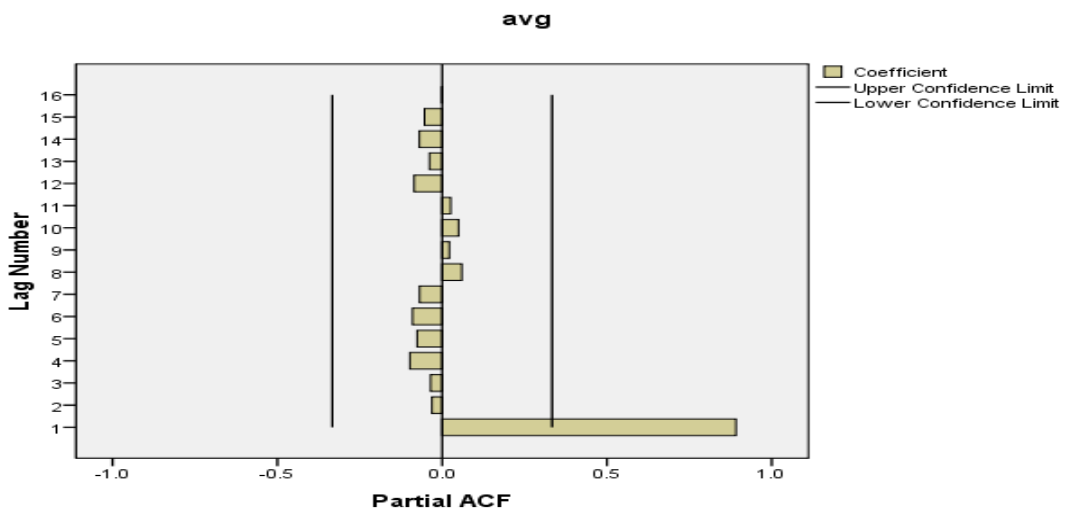


Table – III.2 (a)**Results of Autocorrelations of Inflation Rate**

Series: inflation rate

Lag	Autocorrelation	Std. Error ^a	Box-Ljung Statistic		
			Value	Df	Sig. ^b
1	.334	.160	4.364	1	.037
2	-.036	.158	4.416	2	.110
3	.124	.155	5.052	3	.168
4	-.138	.153	5.865	4	.209
5	-.305	.151	9.981	5	.076
6	-.275	.148	13.425	6	.037
7	-.309	.146	17.923	7	.012
8	.005	.143	17.924	8	.022
9	.275	.140	21.766	9	.010
10	.162	.138	23.144	10	.010
11	.134	.135	24.131	11	.012
12	.283	.132	28.697	12	.004
13	.097	.130	29.255	13	.006
14	-.030	.127	29.309	14	.009
15	.087	.124	29.801	15	.013
16	-.072	.121	30.151	16	.017

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation

Table – III.2 (b)
Results of Partial Autocorrelations of Inflation Rate

Series: inflation rate

Lag	Partial Autocorrelation	Std. Error
1	.334	.167
2	-.166	.167
3	.224	.167
4	-.335	.167
5	-.095	.167
6	-.268	.167
7	-.161	.167
8	.224	.167
9	.188	.167
10	.062	.167
11	-.074	.167
12	.098	.167
13	-.100	.167
14	.158	.167
15	.266	.167
16	.028	.167

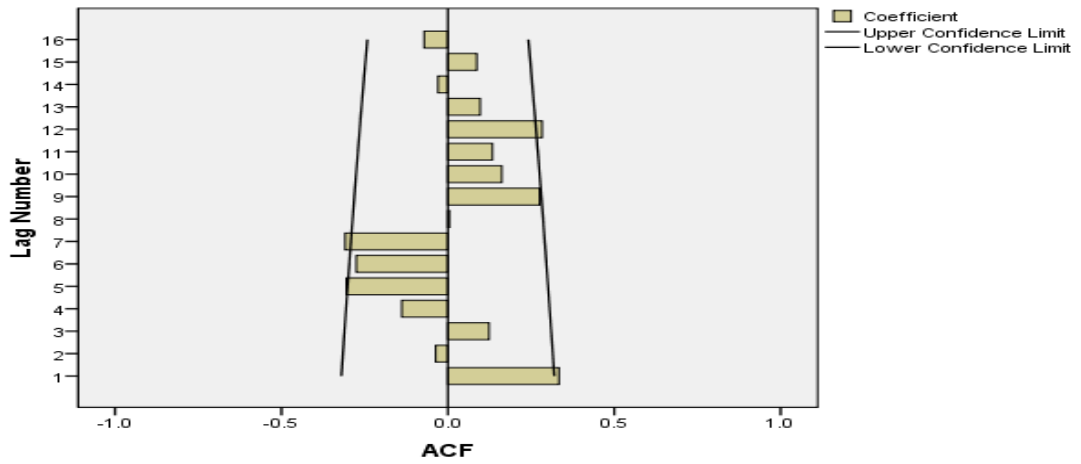
Source: Computed from SPSS Software

Interpretation

Initially residuals are gray noise. So that there is a significant pattern left in the time series. after these significant spikes of ACF or PACF's as shown above tables 4.7 which indicate that there are no significant spikes of ACF or PACF 's of residual are white noise throughout the study period.

Figure

inflation rate



Figure

inflation rate

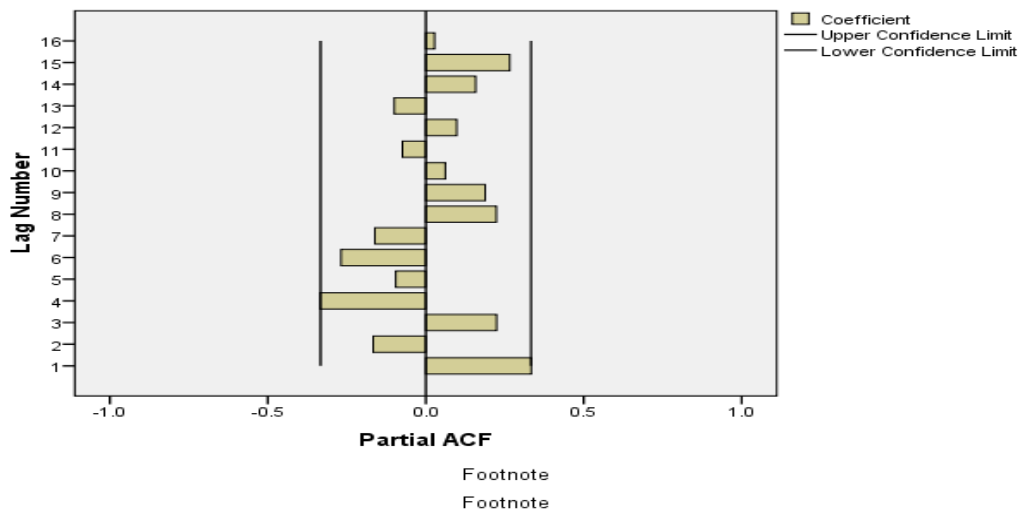


Table – III.3 (a)**Results of Autocorrelations of Interest Rate**

Series: Interest rate

Lag	Autocorrelation	Std. Error ^a	Box-Ljung Statistic		
			Value	Df	Sig. ^b
1	.083	.160	.272	1	.602
2	-.148	.158	1.149	2	.563
3	-.144	.155	2.004	3	.572
4	-.108	.153	2.501	4	.644
5	-.060	.151	2.660	5	.752
6	-.024	.148	2.686	6	.847
7	-.049	.146	2.800	7	.903
8	-.086	.143	3.164	8	.924
9	-.076	.140	3.459	9	.943
10	.037	.138	3.529	10	.966
11	.024	.135	3.560	11	.981
12	.043	.132	3.666	12	.989
13	.038	.130	3.751	13	.994
14	.065	.127	4.012	14	.995
15	.061	.124	4.255	15	.997
16	.158	.121	5.954	16	.989

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation

Table – III.3 (b)
Results of Partial Autocorrelations of Inflation Rate

Series: Interest rate

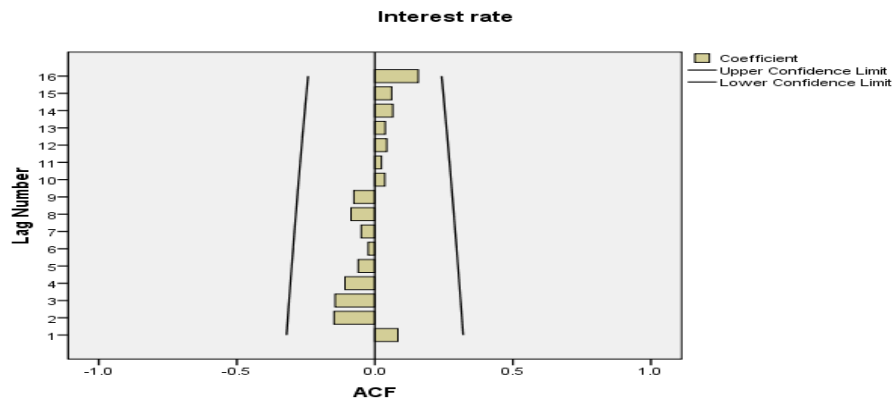
Lag	Partial Autocorrelation	Std. Error
1	.083	.167
2	-.156	.167
3	-.120	.167
4	-.113	.167
5	-.088	.167
6	-.070	.167
7	-.104	.167
8	-.139	.167
9	-.139	.167
10	-.046	.167
11	-.090	.167
12	-.044	.167
13	-.040	.167
14	.016	.167
15	.029	.167
16	.170	.167

Source: Computed from SPSS Software

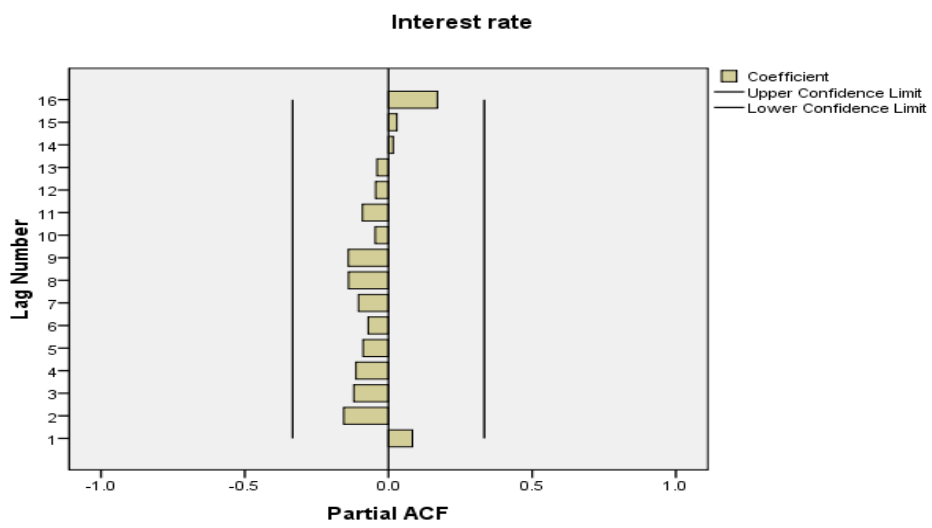
Interpretation

Initially residuals are gray noise. So that there is a significant pattern left in the time series. After these, significant spikes of ACF or PACF's as shown above tables 4.9. Which indicate that there are no significant spikes of ACF or PACF's of residual are white noise throughout the study period.

Figure



Figure



IV. Analysis of GARCH

1. Analysis of GARCH Test of BSE Sensex and Inflation Rate

Table – IV.1

Results of GARCH Test of BSE SENSEX and INFLATION RATE from 01.01.2012 to 31.12.2014

BSE Sensex			Inflation Rate		
Variable	Co-Efficient	Standard Error	Variable	Co-Efficient	Standard Error
C	2.85E+08	2.85E+08	C	0.169518	0.162571
ARCH(1)	0.979708	0.979708	ARCH(1)	-0.235476	0.147754
GARCH(1)	-0.636839	-0.636839	GARCH(1)	1.081480	0.205451
Mean	20670.39		Mean	0.702222	
R-squared	-37.901192		R-squared	-0.921836	
Adjusted R-squared	-40.258840		Adjusted R-squared	-1.038311	
S.D. dependent variable	3405.176		S.D. dependent variable	0.741763	
Akaike info criterion	22.86411		Akaike info criterion	2.829480	
Schwarz criterion	22.99607		Schwarz criterion	2.961439	
Probability	0.9683		Probability	0.0000	

Source: Computed from E-views Software

Interpretation

Form the table 4.11 The basic GARCH (1) Result were depicted the three coefficient in the variance equation are listed as C, The intercept, ARCH (1) the first lag of the squared return, GRACH (1) the first lag of square return, lag of condition variance.

The R-squared of BSE SENSEX -37.901192 and inflation rate -0.921836 shows that there is a linear relationship between two variables and the value is less than 1, it shows that the series are stationarity. This indicates that yesterday’s price as influence is over today’s price.

The value Akaike info criterion is less than Schwarz criterion value in BSE SENSEX and Inflation Rate. It indicates that market is volatile.

The GRACH (1) BSE SENSEX and Inflation Rate were significant at 5% level. And those prices suffered low volatility. It can be clearly understood that there is significant volatility among the prices.

2. Analysis of GARCH Test of BSE SENSEX and INTEREST RATE

Table – IV.2

Results of GARCH Test of BSE and INTEREST RATE from 01.01.2012 to 31.12.2014

BSE Sensex			Interest Rate		
Variable	Co-Efficient	Standard Error	Variable	Co-Efficient	Standard Error
C	2.85E+08	2.85E+08	C	50.87907	2509.224
ARCH(1)	0.979708	0.979708	ARCH(1)	-0.086953	14.31301
GARCH(1)	-0.636839	-0.636839	GARCH(1)	0.453780	35.19291
Mean			Mean		
R-squared		-37.901192	R-squared		-184.730496
Adjusted R-squared		-40.258840	Adjusted R-squared		-195.986890
S.D. dependent variable		3405.176	S.D. dependent variable		0.663796
Akaike info criterion		22.86411	Akaike info criterion		7.380669
Schwarz criterion		22.99607	Schwarz criterion		7.512629
Probability		0.9683	Probability		0.9897

Source: Computed from E-views Software

Interpretation

Form the table 4.12 The basic GARCH (1) Result were depicted the three coefficient in the variance equation are listed as C, The intercept, ARCH (1) the first lag of the squared return, GRACH (1) the first lag of square return, lag of condition variance.

The R-squared of BSE SENSEX and interest rate was -37.901192, -184.730496. It shows that there is a linear relationship between two variables and the value is less than 1. It shows that the series are stationarity. This indicates that yesterday’s price as influence is over today’s price.

The value Akaike info criterion is less than Schwarz criterion value in BSE SENSEX and interest Rate. It indicates that market is volatile.

The GARCH (1) BSE SENSEX and Interest Rate were significant at 5% level. And those prices were suffered low volatility. It can be clearly understood that there is significant volatility among the prices.

Findings of the Study

The following are the findings of the study are:

1. From the analysis the study found that the BSE SENSEX and Inflation Rate has earned maximum return in the year of 2012-2014 (28142.15 and 2.440000)
2. From the analysis the study found that the BSE SENSEX and Interest Rate has earned maximum return in the year of 2012-2014(28142.15 and 10.25000)
3. From the analysis the study found that the BSE SENSEX and Inflation Rate has earned minimum return in the year of 2012-2014 (16357.57 and -1.650000)
4. From the analysis the study found that the BSE SENSEX and Interest Rate has earned minimum return in the year of 2012-2014 (16357.57 and 6.000000)
5. From the study, it could be noted that the overall results of Descriptive statistics of Inflation rate has less impact on BSE SENSEX.
6. From the study, it could be noted that the overall results of Descriptive statistics of Interest rate has less impact on BSE SENSEX.
7. From the analysis of Augmented Dickey Fuller (ADF) both BSE SENSEX and Inflation Rate found to be stationarity at level form.
8. From the analysis of Augmented Dickey Fuller (ADF) both BSE SENSEX and Interest Rate found to be stationarity at level form.
9. From the analysis of Estimate Equation in probability of both BSE SENSEX and Inflation Rate were significant at 1 % level. In addition, that price suffered low volatility.
10. From the analysis of Estimate Equation in probability of both BSE SENSEX and Interest Rate were significant at 5 % level. In addition, that price suffered low volatility.
11. From the analysis, it could be noted that the Estimate Equation in probability of BSE SENSEX and Inflation was (0.9683&0.0000). The BSE SENSEX was not influenced by the Inflation rate. However, BSE SENSEX experienced lower volatile than Inflation rate.
12. From the analysis, it could be noted that the Estimate Equation in probability of BSE SENSEX and Interest Rate was (0.9683&0.9897). The BSE SENSEX was not influenced by the Inflation rate. However, BSE SENSEX experienced lower volatile than Interest rate.
13. The study found that initially there is a significant spike of ADF or PACF's indicates that the residuals are gray noise that is high fluctuation. After that, there is no significant spike of ACF and PACF's residuals are white noise throughout the study period.
14. The study found that the Inflation Rate and Interest Rate has a less impact on BSE SENSEX during the study period.
15. According to the result of GARCH (1, 1) Model is selected sample of Inflation Rate and Interest Rate on BSE SENSEX has experienced the GARCH effect.
16. The study finds that there is a no linear correlation between the impacts of BSE SENSEX against Inflation Rate.
17. The study finds that there is a no linear correlation between the impacts of BSE SENSEX against Interest Rate.

Suggestions of the Study

The following are the suggestion of the study:

1. From the analysis, it is suggested that the risk avoider may prefer the BSE SENSEX since the fluctuation is normal.
2. From the study, it is recommended that the increase and decrease in BSE SENSEX is not a permanent phenomenon due to various reasons.
3. The study suggested that, the RBI and other government agencies have to play their role to tackle this situation
4. Investor should have proper knowledge about the market situation to obtain maximum return minimum risk.

Conclusion

A dynamic capital market is an important segment of the financial system of any country as it plays a significant role in mobilizing savings and channeling them for productive purposes. The study concluded that BSE SENSEX was not influenced by inflation rate and interest rate. Investor should be aware of all the macroeconomics variables but especially they should have knowledge about the inflation rate and interest rate. From the analysis of estimation in probability of both BSE SENSEX and inflation rate were significant AT 1% level. Then the analysis of estimate equation in probability of BSE SENSEX and interest rate were significant at 5% level.

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