Study of Stock Market Efficiency and Impact of Crash on Indian and US Market

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Abstract

The study attempts to find out the market efficiency of Indian and US stock market. For that two main indices of India namely BSE Sensex and CNX Nifty are studied along with US-Dow Jones for a various time brackets between 1993 to 2013. Various tests like K-S Test, Runs test, Auto correlation test, t-test and all descriptive statistics with JB test are conducted for all three indices for a time bracket of 1993-2013, 1993-1995(normal), 1996-2000 (Before DotCom Bubble), 2000-2002 (Dotcom Bubble), 2002-2007 (Before Credit Crisis), 2007-2009 (Credit Crisis) and 2009-2013 (After Credit Crisis). The research summarizes that Indian stock market is not weak form efficient in all periods however; from year 2002 onwards stock market exhibits some signs of efficiency.

Keywords:

Market Efficiency, Indices

Introduction

Emerging markets usually do not have strict standards in accounting and finance regulations and the level of market efficiency as that of advanced economies of the world. However, emerging economy like India and others have physical financial infrastructure including banks, stock exchange, money market and capital market. In addition, investment in emerging markets are sought by investors to tap the market efficiency and thus to earn higher return. However, investments in emerging markets come with higher risk due to political instability, domestic infrastructure problems, currency volatility and limited equity opportunities. However, despite the stage of the different market, it is impossible to 'beat' the market because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. In other words, as per Efficient Market Hypothesis (EMH), stocks always trade at their fair value on stock exchanges, making it impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices. Efficient market hypothesis is stated-weak form, semi strong form and strong form of efficiency on three common forms.

Review of Literature

Malliaris and Urrutia (1992) analyzed possible causal relationship among national stock markets around the October 1987 stock market crash. The paper summarized that lead-lag relationship do not exists before and after market crash. The result provided empirical evidence of the passive role played by Tokyo but fails to confirm leading role played by New York or non-Japanese Asian markets during 1987 crash. Schwert (1989) analyzed behavior of stock return volatility using daily data from 1985 to 1988 and found that on October, 19 there was a largest percentage change in value of the market and stock market volatility jumped during and after market crash. However, it was also observed that it returned to normal level more rapidly than any other historical crises. Research by Yüksel (2002) on Istanbul Stock Exchange during the Russian crisis in 1998 says that the comparison of the relationship during the crisis period to those during pre and post crisis period proved that there was a structural change regarding the price impact of the trading volume. Chancharoenchai and Dibooglu (2006) examined the volatility spillovers in Southeast Asian emerging markets in the context of the mid-1997 financial crisis, and found spillover effects between various equity markets. The paper summarized that the sudden fallout in Thailand seems to have played an important role in the variation in excess returns in other Southeast Asian markets and it supports the idea of the "Asian Contagion" suggested that the crisis started in the Thailand and spread over to other financial markets. Olowe (2009) found that in the Nigerian Stock market returns show persistence in volatility and clustering and asymmetric properties.

Kazi et al (2011) investigated the contagion effect between stock market of US and sixteen OECD countries due to global financial crisis and it found existence of contagion effect between US and 16 OECD countries. Boyer et al (2006) provided empirical evidence that market crises are speeded globally. Authors categorized the stock markets of emerging economies in to two parts: those that are eligible for purchase by foreigners and those that are not. Research proved that greater co-movement during high volatility period, especially for accessible stock index returns indicates that crises spread through the asset holding of the international investors rather than through changes in fundamentals. A novel approach was adopted by Herrero et al (2008) as they applied event study methodology to analyze whether five south East Asian countries which devalued in 1997 namely Indonesia, Korea, Malaysia, Philippines and Thailand. The study was based on the assumption that the expectation of devaluation should help the stock of exporting firms outperform those of non-performing firms and the study could find evidence to support this hypothesis, however at different degrees depending upon the country.

Study by Salman et al (2012) attempted the short term relationship between Karachi Stock Exchange, Bombay Stock Exchange, Hong Kong Stock Exchange, and Tokyo Stock Exchange after the financial crisis of 2007. It concluded that 1. Tokyo and Karachi Stock Exchange, 2. Hong Kong and Bombay, 3. Karachi and Bombay (before and after crisis) 4. Tokyo and Bombay have no short term relationship with each other; while Tokyo and Hong Kong stock exchange have short term relationship with each other after the financial crisis of 2007. Research by Dhal (2009) derives some crucial insights from the multivariate co integration analysis of stock prices indices for the global markets of the US, UK, Japan, Hong Kong, Singapore and India. Result says that these markets shared single co integration relationship and the Indian market played a key role and the analysis showed that global crisis could not have been associated with the breakdown of the long-run relationships among the markets. Ghosh (2006) tried to address India's existence from the effect of financial crisis and analyzed that India's success can be attributed to key policy decisions namely devaluation, IMF, partial liberalization of the domestic financial sector and graduation opening of the external sector. In a similar track paved by Ghosh (2006); Study by Jeyanthi et al (2012) summarized that there was no short term as well as long term negative impact of financial crisis on the Indian stock exchange. Further, the paper found that the Indian stock market was unaffected by the global financial crisis. Study by Patel et al (2011) confirmed the existence of weak form of efficiency in Indian market for a time period of 2004 to 2011. Jethwani, Achuthan (2013) investigated weak form efficiency of the Indian market during, before and after financial crisis and the result shows that Indian market is not weak form efficient in all period and after 2002 it behaves in a more efficient way. This confirms with the earlier study conducted by Patel et al (2011).

Data Description

Objectives

1. To examine the market efficiency level of selected stock markets and to test spillover effect of the financial crash for a period of 1993 to 2013 for Indian and US stock market.
2. To study and examine the extent of crisis at various periods for the given stock markets and to derive efficiency level of Indian stock market.

To study the above mentioned objectives, two main indices of India and one of US are selected as sample for the study. The daily closing prices of BSE SENSEX, CNX NIFTY 50 and DOW JONES of last 21 years is collected (1st January 1993-31st December 2013). The daily price values of the CNX Nifty 50 and BSE Sensex is collected from the website

of NSE and BSE respectively. Dow Jones data are collected from yahoo finance. The period was further broken in to 1993-2013 (Total study period), 1993-1995 (Normal), 1996-2000 (Before Dot com Bubble), 2000-2002 (Dot com Bubble), 2002-2007 (Before Credit Crisis), 2007-2009 (Credit Crisis) and 2009-2013 (After Credit Crisis). Before conducting any test, it is required to test whether data are stationary or not and for that Augmented Dicky Fuller Test (ADF) was conducted.

Returns are calculated using logarithmic method and it was analyzed by using time series volatility. Further, to study the variability in stock prices, standard deviation is used as a proxy. The logarithmic method to calculate return is as follows:

$$R_t = \text{In}\ (I_t / I_{t-1})^* 100$$

Where R_t stands for return of the index and I_t indicate index value at time't'.

To compute standard deviation following standard formula was used.

$$sd = \sqrt{1/n \sum \log\left(\frac{Ht}{Lt}\right) 2}$$

Data collection and interpretation

Augmented Dicky Fuller (ADF) test indicates that data are stationary at first difference.

Normality test

Many statistical tests (e.g. t-test) require that data are normally distributed and therefore it should always be checked if this assumption is satisfied. The null hypothesis is that the data is normally distributed and the alternative hypothesis is that the data is not normally distributed. The Kolmogorov-Smirnov test is used for sample of more than 2000. If p-value is less than 0.05, null hypothesis is rejected.

Here as p value is 0.00 for all three indices (table 1 of appendix A B and C), null hypothesis is rejected which means that data are not normally distributed. Hence, non-parametric tests are conducted.

It is a non-parametric test and is used to test weak form of efficiency of stock market. This test emphasizes on the direction of change and does not consider the change in value. The test ignores the type of distribution followed in time series and is used to check the randomness in time series under consideration. At 5% confidence level, if the observed value of z is 1.96, null hypothesis is accepted. Following are the null hypothesis to check efficiency of the market.

1. Indian Stock Market is weak form efficient market.

2. Indian Stock market follows random walk

Analysis for Descriptive Statistics:

To study the above mentioned objectives, one of the basic requirements is that data should be normal. Usually, main two parameters namely mean and variances are used to describe the distribution. For that skewness, kurtosis, Jarque-Bera test is applied to test the normality of the data. Jarque-Bera test is a goodness of fit test of whether the sample data have the skewness and kurtosis matching a normal distribution. In the data, when the skewness is zero, kurtosis is three and JB is zero, then it is perfectly normally distributed. Coefficient of variation shows volatility of the data.

SENSEX

Five (1993-2013,1993-1995, 2000-2002, 2002-2007, 2007-2009) out of seven periods under study has negative skewness, though the value is small; it indicates the tail on the left side is longer than the right side and the bulk of the values lies including median to the right side of the mean. Remaining two periods (1996-2000, 2009-2013) shows positive skewness. In case of Kurtosis, four period (1993-1995, 1996-2000, 2000-2002, 2007-2009) out of seven falls under Platykurtic distribution and other three periods (1993-2013, 2002-2007, 2009-2013) falls under Leptokurtic distribution. Therefore, it can be said that distribution of data is not normal. So on the basis of descriptive statistics, null hypothesis of random walk is rejected. For Jarque Bera Test, null hypothesis of random walk is rejected for all periods as value of JB is higher than zero. Coefficient of Variation in initial two periods (1993-2013, 1993-1995) is quite high compare to other five periods. The value of CV shows that gradually market has become less volatile. (Refer to Table No.2 of appendix A)

CNX NIFTY

Four (1993-2013, 2000-2002, 2002-2007, 2007-2009) out of seven periods under study has negative skewness, and it indicates the tail on the left side is longer than the right side and the bulk of the values lies including median to the right side of the mean. Remaining three periods (1993-1995, 1996-2000, 2009-2013) shows positive skewness. In case of Kurtosis, three period (1993-1995, 2000-2002, 2007-2009) out of seven falls under Platykurtic distribution and other four periods (1993-2013, 1996-2000, 2002-2007, 2009-2013) falls under Leptokurtic distribution. Hence, it can be summarized that distribution of data is not normal. So on the basis of descriptive statistics, null hypothesis of random walk is rejected. Jarque Bera test and coefficient of variation indicates same conclusion as that of Sensex. (Refer to Table No. 2 of Appendix B)

DOWJONES

Five (1993-2013,1993-1995, 1996-2000, 2000-2002, 2009-2013) out of seven periods under study has negative skewness, even if the value is small it indicates the tail on the left side is longer than the right side and the bulk of the values lies including median to the right side of the mean. Remaining two periods (2000-2007, 2007-2009) are having positive skewness. In case of Kurtosis, three period (1993-1995, 2000-2002, 2002-2007) out of seven falls under Platykurtic distribution and other four periods (1993-2013, 2002-2007, 2009-2013) falls under Leptokurtic distribution. Hence, we can say that distribution of data is not normal. So on the basis of descriptive statistics, null hypothesis of random walk is rejected. For Jarque Bera Test, null hypothesis of random walk is rejected for all periods as value of Jarque Bera is higher than zero. Coefficient of Variation is quite high in the overall period only. (Refer to Table No. 2 of Appendix C)

In summary, for Sensex except two periods (1993-1995, 2007-2009), remaining five periods are not normally distributed and which leads to rejection of the null hypothesis of random walk and similar result is found for CNX Nifty. While for the Dow Jones in all seven periods, the value of P is significant. That means the data is not normally distributed which leads to rejection of the null hypothesis of random walk for these periods.

Runs Test and analysis

For both the indices namely Sensex and Nifty, two (2007-2009, 2009-2013) out of seven periods the value of Z is insignificant at 5 % significance level and its value lies inside the interval of ±1.96, so null hypothesis of random walk is accepted. While in five (1993-2013, 1993-1995, 1996-2000, 2000-2002, and 2002-2007) out of seven periods, null hypothesis of random walk is rejected (Refer to Table No. 4 of Appendix A, B). While for the Dow Jones in four periods (1993-1995, 1996-2000, 2000-2002, 2009-2013) out of seven periods the value of Z is insignificant at 5 % significance level and its value lies inside the interval of ±1.96, so null hypothesis of random walk is accepted. While in three (1993-2013, 2002-2007, 2007-2009) out of seven periods, null hypothesis of random walk is rejected. (Table 4 of Appendix C).

Autocorrelation and analysis

Autocorrelation is the cross-correlation of a signal with itself as it describes the correlation between values of the process at different times as a function of the two times or of the time lag. For null hypothesis to be true, observed serial correlation should not be statistically significant i.e. should not be greater than three times the standard error of coefficient. In case of Ljung Box Q statistics, if the value of P <0.05 then it can be said that autocorrelation exist.

For all three indices namely Sensex, CNX Nifty and Dow Jones in all periods the value of P is significant which means that autocorrelation exists in the series. In addition to that, there is at least one lag where correlation coefficient is > 3*Standard error for all periods. Hence, existence of autocorrelation ultimately rejects the null hypothesis of random walk in all periods. (Table No. 6 of Appendix A, B and C).

Kruskal-Wallis test

Kruskal-Wallis test is a one-way analysis of variance by ranks and a non-parametric method to test whether samples originate from the same distribution. The method is used for comparing more than two samples that are independent or not related and it does not assume a normal distribution of the residuals. The null hypothesis are.

H_0: All Three Stock market indices follow the random walk for the entire period i.e. from year 1993 to 2013.

H_0: Random walk follows among all three indices before the credit crisis i.e. from year 2002 to 2007.

H_0: Random walk follows among all three indices during the credit crisis i.e. from year 2007 to 2009.

H_0: Random walk follows among all three indices after the credit crisis i.e. from year 2009 to 2013.

Table A: - Kruskal Wallis For The Entire Period

Test Statistics[a,b]	
	RETURN
Chi-Square	1.072
df	2
Asymp. Sig.	.585
a. Kruskal Wallis Test	
b. Grouping Variable: INDICES	

Table B:- Kruskal Wallis For The Period 2002-2007

Test Statistics[a,b]	
	RETURN
Chi-Square	26.098
df	2
Asymp. Sig.	.000
a. Kruskal Wallis Test	
b. Grouping Variable: INDICES	

Table C:- Kruskal Wallis For The Period 2007-2009

Test Statistics[a,b]	
	RETURN
Chi-Square	.049
df	2
Asymp. Sig.	.976
a. Kruskal Wallis Test	
b. Grouping Variable: INDICES	

Table D:- Kruskal Wallis For The Period 2009-2013

Test Statistics[a,b]	
	RETURN
Chi-Square	1.357
df	2
Asymp. Sig.	.507
a. Kruskal Wallis Test	
b. Grouping Variable: INDICES	

If the P value is small, it rejects the idea that the difference is due to random sampling. For the entire period the p-value is 0.585, for the period of 2002-2007, the p-value is 0.000, for the period of 2007-2009, the p-value is 0.976 and for the period of 2009-2013, the p-value is 0.507

Consequently, it can be concluded that only before the period of credit crisis, the difference is not due to random sampling. Random walk follows between all three indices for entire period of 21 years as well as during the credit crisis and after the crisis period. A random walk is defined by the fact that price changes are independent of each other.

Conclusion

This study investigates the market efficiency of selected three stock markets. In addition to that, this research analyses that whether the crisis period alters the conclusion of efficiency of the stock market. The daily return series of SENSEX, S&P CNX Nifty and Dow Jones for a period of 1993 to 2013 is considered for the study. The research summarizes that Indian stock market is not weak form efficient in all periods however, from year 2002 onwards stock market exhibits some signs of efficiency. Further, all three independent samples are compared and is concluded that it follows random walk during and after the crisis period but not before the crisis period.

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Appendices

Table A:-ADF for BSE

ADF Test Statistic	-33.55698	1% Critical Value*		-3.4348
		5% Critical Value		-2.8626
		10% Critical Value		-2.5674
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(CLOSE,2)				
Method: Least Squares				
Date: 12/19/13 Time: 16:44				
Sample(adjusted): 1/11/1993 5/04/2012				
Included observations: 5040 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CLOSE(-1))	-1.009154	0.030073	-33.55698	0.0000
D(CLOSE(-1),2)	0.082824	0.026836	3.086319	0.0020
D(CLOSE(-2),2)	0.078042	0.023238	3.358451	0.0008
D(CLOSE(-3),2)	0.054351	0.019199	2.830950	0.0047
D(CLOSE(-4),2)	0.046042	0.014088	3.268078	0.0011
C	3.389471	2.206431	1.536179	0.1246
R-squared	0.464436	Mean dependent var		-0.008262
Adjusted R-squared	0.463904	S.D. dependent var		213.7032
S.E. of regression	156.4704	Akaike info criterion		12.94480
Sum squared resid	1.23E+08	Schwarz criterion		12.95257
Log likelihood	-32614.90	F-statistic		873.0882
Durbin-Watson stat	2.004013	Prob(F-statistic)		0.000000

Table B:- ADF for NSE

ADF Test Statistic	-33.34988	1% Critical Value*		-3.4348
		5% Critical Value		-2.8626
		10% Critical Value		-2.5674
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(CLOSE,2)				
Method: Least Squares				
Date: 12/19/13 Time: 16:50				
Sample(adjusted): 1/11/1993 6/08/2012				
Included observations: 5065 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CLOSE(-1))	-1.004996	0.030135	-33.34988	0.0000
D(CLOSE(-1),2)	0.067270	0.026919	2.499027	0.0125
D(CLOSE(-2),2)	0.069741	0.023318	2.990804	0.0028
D(CLOSE(-3),2)	0.047503	0.019269	2.465217	0.0137
D(CLOSE(-4),2)	0.041637	0.014057	2.962037	0.0031
C	0.998543	0.663774	1.504342	0.1326
R-squared	0.469785	Mean dependent var		-0.004859
Adjusted R-squared	0.469261	S.D. dependent var		64.77475
S.E. of regression	47.18961	Akaike info criterion		10.54741
Sum squared resid	11265683	Schwarz criterion		10.55514
Log likelihood	-26705.31	F-statistic		896.4813
Durbin-Watson stat	2.003658	Prob(F-statistic)		0.000000

Appendix A BSE Sensex

Table 1:-Test for Normality:

Tests of Normality			
	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
BSE	.051	5147	.000
a. Lilliefors Significance Correction			

Table 2:-Descriptive statistics of different period

N	TIME PERIOD	MEAN	STD. DEV.	COE. OF VAR.	SKEWNESS	KURTOSIS	JORQUE BERRA
5045	1993-2013	0.040	1.638	40.689	-0.099	4.967	5194.549
676	1993-1995	0.030	1.533	51.099	-0.012	1.560	68.574
1025	1996-2000	0.052	1.767	33.964	0.032	1.869	149.383
645	2000-2002	-0.091	1.725	-19.050	-0.410	2.139	141.015
1272	2002-2007	0.150	1.398	9.339	-0.768	6.650	2468.519
346	2007-2009	-0.207	2.677	-12.960	-0.149	1.037	16.764
1243	2009-2013	0.063	1.380	21.828	1.152	15.550	12798.870

Table 3:-Descriptive statistics of each year

N	TIME	MEAN	STD. DEV.	CO. OF VAR.	SKEWNESS	KURTOSIS	JORQUE BERRA
214	1993	0.129	1.864	14.467	-0.442	1.153	18.820
231	1994	0.069	1.435	20.716	0.577	1.783	43.419
231	1995	-0.101	1.261	-12.502	0.115	0.385	1.934
238	1996	-0.003	1.522	-443.773	0.504	0.974	19.508
246	1997	0.069	1.638	23.622	-0.309	4.315	194.741
244	1998	-0.074	1.908	-25.821	-0.046	1.306	17.413
248	1999	0.199	1.815	9.118	0.053	1.492	23.121
250	2000	-0.093	2.204	-23.822	-0.243	0.946	11.787
248	2001	-0.079	1.719	-21.655	-0.462	1.679	37.976
251	2002	0.014	1.102	79.903	0.142	1.494	24.175
254	2003	0.216	1.166	5.410	-0.190	0.133	1.712
254	2004	0.048	1.610	33.266	-1.554	13.748	2102.653
251	2005	0.141	1.080	7.682	-0.442	0.405	9.890
250	2006	0.153	1.627	10.616	-0.485	3.002	103.683
249	2007	0.155	1.544	9.954	-0.210	1.455	23.786
246	2008	-0.302	2.853	-9.442	-0.069	0.904	8.567
243	2009	0.244	2.186	8.950	1.313	10.922	1277.570
252	2010	0.064	1.006	15.782	-0.254	0.650	7.149
247	2011	-0.115	1.321	-11.529	0.279	0.058	3.241
251	2012	0.091	0.919	10.082	0.088	0.623	4.389
250	2013	0.034	1.096	31.865	-0.111	1.429	21.779

Table 4:-Runs test

TIME PERIOD	TEST VALUE a	CASES<TEST VALUE	CASES>=TEST VALUE	TOTAL CASES	NUMBER OF RUNS	Z	P VALUE
1993-2013	0.0402	2454	2591	5045	2299	-6.274	0
1993-1995	0.03	339	336	675	270	-5.277	0
1996-2000	0.052	521	504	1025	480	-2.086	0.037
2000-2002	-0.0905	306	339	645	289	-2.659	0.008
2002-2007	0.1496	602	670	1272	593	-2.373	0.018
2007-2009	-0.2065	173	173	346	160	-1.507	0.132
2009-2013	0.07	621	622	1243	599	-1.334	0.182

Table 5:-T- Test

PERIOD	T	DF	SIGNIFICANCE	MEAN DIFF	LOWER	UPPER
1993-2013	1.746	5044	0.081	0.040	-0.005	0.085
1993-1995	0.509	674	0.611	0.030	-0.086	0.146
1996-2000	0.943	1024	0.346	0.052	-0.056	0.160
2000-2002	-1.333	644	0.183	-0.091	-0.224	0.043
2002-2007	3.819	1271	0.000	0.150	0.073	0.227
2007-2009	-1.435	345	0.152	-0.207	-0.490	0.077
2009-2013	1.615	1242	0.107	0.063	-0.014	0.140

Table 6:-Auto correlation test

PERIOD	LAGS	1	2	3	4	5	6	7	8	9	10
1993-2013	AC	-0.434	-0.077	0.003	0.024	-0.003	-0.046	0.023	0.009	0.003	0.024
	STD. ERROR	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
	Q Stat	951.428	981.670	981.722	984.716	984.757	995.237	997.999	998.447	998.495	1001.000
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993-1995	AC	-0.276	-0.224	-0.031	-0.007	0.064	-0.024	0.032	-0.053	-0.017	0.098
	STD. ERROR	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
	Q Stat	51.485	85.393	86.055	86.087	88.840	89.219	89.899	91.836	92.024	98.604
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1996-2000	AC	-0.485	-0.034	0.023	0.036	-0.021	-0.076	0.064	-0.021	0.025	0.020
	STD. ERROR	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031
	Q Stat	242.010	243.201	243.724	245.087	245.529	251.549	255.763	256.199	256.844	257.273
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2000-2002	AC	-0.419	-0.066	-0.053	0.063	-0.014	-0.026	-0.005	0.017	0.045	-0.025
	STD. ERROR	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
	Q Stat	113.744	116.556	118.387	120.937	121.061	121.508	121.525	121.710	123.009	123.429
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2002-2007	AC	-0.420	-0.139	0.031	0.067	-0.009	-0.039	-0.009	-0.010	0.010	0.073
	STD. ERROR	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	Q Stat	224.359	248.858	250.069	255.753	255.853	257.822	257.924	258.065	258.181	265.090
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2007-2009	AC	-0.445	-0.055	0.060	-0.104	0.037	-0.036	-0.016	0.152	-0.082	-0.032
	STD. ERROR	0.054	0.054	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
	Q Stat	68.893	69.946	71.190	74.952	75.440	75.907	75.993	84.186	86.575	86.939
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2009-2013	AC	0.455	-0.037	-0.025	0.037	-0.021	-0.035	0.046	-0.033	0.047	-0.004
	STD. ERROR	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	Q Stat	257.482	259.186	259.976	261.651	262.191	263.700	266.295	267.692	270.476	270.499
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Appendix B:- CNX Nifty NSE

Table 1:- Test for Normality

Tests of Normality			
	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
NSE	.054	5172	.000
a. Lilliefors Significance Correction			

Table 2:- Descriptive statistics of different periods

N	TIME PERIOD	MEAN	STD. DEV.	COF. OF VAR.	SKEWNESS	KURTOSIS	JORQUE BERRA
5070	1993-2013	0.040	1.624	40.323	-0.129	6.097	7865.758
679	1993-1995	0.029	1.469	50.243	0.043	1.078	33.095
1047	1996-2000	0.054	1.761	32.488	0.161	3.207	453.170
645	2000-2002	-0.080	1.606	19.995	-0.353	2.565	190.204
1272	2002-2007	0.143	1.464	10.227	-0.962	7.728	3361.353
346	2007-2009	-0.193	2.619	13.534	-0.345	1.785	52.800
1243	2009-2013	0.061	1.381	22.702	1.210	16.200	13895.013

Table 3:- Descriptive statistics of each year

N	PERIOD	MEAN	STD. DEV.	COF. OF VAR.	SKEWNESS	KURTOSIS	JORQUE BERRA
213	1993	0.158	1.744	11.046	-0.347	0.365	5.457
230	1994	0.055	1.400	25.612	0.634	1.961	52.260
236	1995	-0.112	1.242	-11.130	-0.106	0.752	5.996
250	1996	-0.004	1.526	-365.632	0.696	1.103	32.820
244	1997	0.075	1.798	24.010	0.058	7.564	581.841
250	1998	-0.080	1.777	-22.280	-0.094	1.617	27.594
254	1999	0.203	1.837	9.056	0.045	2.247	53.510
250	2000	-0.063	2.002	-31.591	-0.105	1.491	23.620
248	2001	-0.071	1.630	-22.900	-0.462	2.262	61.672
251	2002	0.013	1.061	83.184	0.078	1.457	22.463
254	2003	0.213	1.232	5.777	-0.337	0.470	7.134
254	2004	0.040	1.763	44.122	-1.802	14.397	2331.090
251	2005	0.124	1.114	9.017	-0.517	0.592	14.831
250	2006	0.134	1.650	12.305	-0.620	2.731	93.720
249	2007	0.175	1.601	9.130	-0.258	1.558	27.955
246	2008	-0.297	2.808	-9.467	-0.283	1.688	32.505
243	2009	0.232	2.143	9.233	1.508	12.621	1704.950
252	2010	0.066	1.024	15.634	-0.277	0.670	7.939
247	2011	-0.114	1.321	-11.548	0.270	0.057	3.045
251	2012	0.097	0.955	9.801	0.076	0.662	4.818
250	2013	0.026	1.138	43.529	-0.116	1.514	24.447

Table 4:- Runs test

TIME PERIOD	TEST VALUE a	CASES<TEST VALUE	CASES>=TEST VALUE	TOTAL CASES	NUMBER OF RUNS	Z	P VALUE
1993-2013	0.0403	2483	2587	5070	2293	-6.799	0
1993-1995	0.0293	346	332	678	261	-6.064	0
1996-2000	0.0542	537	510	1047	469	-3.413	0.001
2000-2002	-0.0803	308	337	645	283	-3.147	0.002
2002-2007	0.1432	593	679	1272	591	-2.429	0.015
2007-2009	-0.1935	164	182	346	168	-0.597	0.55
2009-2013	0.05	621	622	1243	607	-0.88	0.379

Table 5:- T-test

PERIOD	T	DF	SIGNIFICANCE	MEAN DIFF	LOWER	UPPER
1993-2013	1.766	5069	0.077	0.040	-0.004	0.085
1993-1995	0.519	677	0.604	0.029	-0.082	0.140
1996-2000	0.996	1046	0.319	0.054	-0.053	0.161
2000-2002	-1.27	644	0.204	-0.080	-0.205	0.044
2002-2007	3.487	1271	0.001	0.143	0.063	0.224
2007-2009	-1.374	345	0.170	-0.193	-0.470	0.083
2009-2013	1.553	1242	0.121	0.061	-0.016	0.138

Table 6:- Auto correlation test

PERIOD	LAGS	1	2	3	4	5	6	7	8	9	10
1993-2013	AC	-0.433	-0.084	0.009	0.018	0.013	-0.053	0.024	0.005	-0.004	0.042
	STD. ERROR	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
	Q Stat	952.337	988.317	988.750	990.450	991.253	1005.383	1008.201	1008.328	1008.416	1017.488
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993-1995	AC	-0.242	-0.268	-0.004	-0.006	0.018	0.003	0.057	-0.099	0.019	0.100
	STD. ERROR	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
	Q Stat	39.869	88.876	88.885	88.910	89.139	89.146	91.396	98.057	98.296	105.211
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1996-2000	AC	-0.491	-0.030	0.026	0.003	0.039	-0.086	0.046	-0.025	0.002	0.071
	STD. ERROR	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031
	Q Stat	253.300	254.300	254.990	255.000	256.600	264.460	266.640	267.300	267.300	272064.000
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2000-2002	AC	-0.387	-0.120	-0.030	0.043	0.035	-0.036	-0.046	0.056	0.020	-0.014
	STD. ERROR	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
	Q Stat	96.830	106.900	107.510	108.710	109.510	110.360	111.770	113.820	114.080	114.220
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2002-2007	AC	-0.406	-0.150	0.037	0.069	-0.017	-0.028	-0.012	-0.011	-0.002	0.089
	STD. ERROR	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	Q Stat	210.073	241.870	243.576	249.644	250.013	250.984	251.178	251.343	251.351	261.438
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2007-2009	AC	-0.461	-0.030	0.044	-0.086	0.042	-0.062	0.007	0.140	-0.070	-0.046
	STD. ERROR	0.054	0.054	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
	Q Stat	73.867	74.260	74.936	77.515	78.135	79.491	79.510	86.436	88.182	88.945
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2009-2013	AC	-0.469	-0.020	-0.027	0.039	-0.021	-0.045	0.058	-0.039	0.047	0.001
	STD. ERROR	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	Q Stat	273.528	274.037	274.950	276.821	277.361	279.904	284.134	286.079	288.879	288.880
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Appendix C:- Dow Jones

Table 1:- Test for Normality

Tests of Normality			
	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
DOW JONES	.080	5288	.000
a. Lilliefors Significance Correction			

Table 2:- Descriptive statistics of different periods

N	TIME PERIOD	MEAN	STD. DEV.	CV	SKEW	KURT	JB
5288	1993-2013	0.030	1.128	37.019	-0.165	8.240	14985.608
756	1993-1995	0.058	0.598	10.370	-0.361	1.758	113.743
1059	1996-2000	0.063	1.092	17.448	-0.574	4.292	871.055
647	2000-2002	-0.048	1.403	-29.325	-0.076	2.611	184.335
1274	2002-2007	0.051	0.835	16.411	0.216	2.717	401.955
355	2007-2009	-0.170	2.269	-13.318	0.262	3.526	187.931
1197	2009-2013	0.065	0.999	15.355	-0.355	3.186	531.374

Table 3:- Descriptive statistics of each year

N	YEAR	MEAN	STD. DEV.	CV	SKEW	KURT	JB
252	1993	0.050	0.548	10.940	-0.379	2.250	59.160
252	1994	0.008	0.688	81.942	-0.331	1.324	22.993
252	1995	0.115	0.544	4.752	-0.229	1.318	20.439
254	1996	0.091	0.755	8.298	-0.593	1.776	48.264
253	1997	0.081	1.184	14.676	-0.846	6.583	487.012
252	1998	0.059	1.256	21.203	-0.548	4.274	204.394
252	1999	0.089	1.017	11.396	0.044	-0.100	0.187
252	2000	-0.025	1.309	-51.813	-0.283	1.738	35.093
248	2001	-0.030	1.350	-45.447	-0.571	4.065	184.215
252	2002	-0.073	1.604	-22.023	0.494	1.234	26.229
252	2003	0.090	1.043	11.646	0.112	1.133	14.021
252	2004	0.012	0.683	55.536	0.010	-0.115	0.143
252	2005	-0.002	0.649	-268.501	-0.004	0.040	0.018
251	2006	0.060	0.622	10.338	-0.110	1.239	16.550
251	2007	0.025	0.918	36.960	-0.623	1.637	44.268
253	2008	-0.163	2.381	-14.583	0.227	3.822	156.163
252	2009	0.068	1.524	22.274	0.072	2.181	50.180
252	2010	0.041	1.018	24.541	-0.177	2.162	50.415
252	2011	0.021	1.328	62.201	-0.532	2.572	81.332
250	2012	0.028	0.743	26.513	0.027	0.916	8.774
252	2013	0.093	0.640	6.860	-0.202	1.362	21.176

Table 4:- Runs test

TIME PERIOD	TEST VALUE a	CASES<TEST VALUE	CASES>=TEST VALUE	TOTAL CASES	NUMBER OF RUNS	Z	P VALUE
1993-2013	0.05	2644	2644	5288	2758	3.108	0.002
1993-1995	0.07	378	378	756	386	0.51	0.61
1996-2000	0.07	529	530	1059	520	-0.646	0.519
2000-2002	-0.05	323	324	647	332	0.59	0.555
2002-2007	0.06	637	637	1274	691	2.971	0.003
2007-2009	-0.1	177	178	355	200	2.286	0.022
2009-2013	0.07	598	599	1197	619	1.128	0.259

Table 5:- T test

PERIOD	T	DF	SIGNIFICANCE	MEAN DIFF	LOWER	UPPER
1993-2013	1.964	5287	0.050	0.030	0.000	0.061
1993-1995	2.651	755	0.008	0.058	0.015	0.100
1996-2000	1.865	1058	0.062	0.063	-0.003	0.128
2000-2002	-0.867	646	0.386	-0.048	-0.156	0.060
2002-2007	2.175	1273	0.030	0.051	0.005	0.097
2007-2009	-1.415	354	0.158	-0.170	-0.407	0.067
2009-2013	2.253	1196	0.024	0.065	0.008	0.122

Table 6:- AUTO CORRELATION TEST

PERIOD	LAGS	1	2	3	4	5	6	7	8	9	10
1993-2013	AC	-0.507	-0.023	0.040	0.011	-0.047	0.043	-0.040	0.032	-0.027	0.050
	STD. ERROR	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
	Q Stat	1360.000	1360.000	1370.000	1370.000	1380.000	1390.000	1400.000	1410.000	1410.000	1420.000
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993-1995	AC	-0.485	0.022	-0.039	-0.017	0.028	-0.019	0.015	0.004	-0.024	0.020
	STD. ERROR	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036
	Q Stat	178.266	178.632	179.794	180.013	180.605	180.877	181.057	181.067	181.520	181.830
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1996-2000	AC	-0.473	-0.014	-0.047	0.052	-0.033	0.037	-0.037	-0.008	0.000	0.107
	STD. ERROR	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031
	Q Stat	237.207	237.417	239.815	242.693	243.885	245.330	246.798	246.868	246.868	259.059
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2000-2002	AC	-0.450	-0.114	0.078	0.016	-0.042	-0.010	0.028	-0.010	0.024	0.011
	STD. ERROR	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
	Q Stat	131.445	139.832	143.842	144.003	145.165	145.232	145.747	145.812	146.186	146.261
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2002-2007	AC	-0.569	0.099	-0.062	0.092	-0.097	0.088	-0.098	0.082	-0.062	0.045
	STD. ERROR	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	Q Stat	413.741	426.202	431.061	441.977	453.922	463.832	476.148	484.783	489.649	492.197
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2007-2009	AC	-0.502	-0.126	0.218	-0.091	-0.042	0.086	-0.095	0.087	-0.054	0.052
	STD. ERROR	0.053	0.053	0.053	0.053	0.053	0.053	0.052	0.052	0.052	0.052
	Q Stat	89.809	95.481	112.595	115.599	116.246	118.909	122.183	124.910	125.960	126.956
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2009-2013	AC	-0.558	0.123	-0.124	0.118	-0.096	0.030	0.018	-0.019	-0.009	0.019
	STD. ERROR	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
	Q Stat	373.439	391.718	410.075	426.899	437.939	439.028	439.399	439.833	439.933	440.386
	Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000