EXPLORING AUTOCORRELATION IN NSE AND NASDAQ DURING RECENT FINANCIAL CRISIS PERIOD

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According to the Random walk hypothesis, the stock prices move randomly and as a result past prices are not helpful in predicting future prices. Researchers and academicians have conducted different tests and used various approaches to the applicability and reliability of this hypothesis. But, so far, the results of these studies are found to be contradictory. Some concluded that a particular market followed random walk but others rejected this result. In order to explore the same hypothesis, S&P CNX NIFTY from National Stock Exchange (NSE) of India and the NASDAQ Composite from the National Association of Securities Dealers Automated Quotations (NASDAQ) Stock Market in the United States of America (USA) has been taken and analyzed for random walk during 1ˢᵗ January 2008 to 31ˢᵗ December 2010. The indexes have been tested through autocorrelation function.

The empirical results do not support the validity of weak-form efficiency for stock market returns of Indian and USA stock exchanges. This implies that the Indian and USA stock markets are not weak form efficient indicating that there is systematic way to take advantage of the trading opportunities and earn abnormal returns.

Key Words: Random Walk Hypothesis, Weak Form Efficiency, NSE, NASDAQ

JEL Classification: G14

INTRODUCTION

The random walk theory was given by Fama (1965) for the first time on his Ph.D thesis, where he had mentioned that the stock price follow random walk and adjusts according to new information introduced in the market. The stock market is said to be efficient if all the information available in the market is reflected in the stock prices. The faster a market adjusts to new information, the more efficient it is considered. This makes it difficult for the investors to beat the market because all the past information is reflected in the prices, which makes earning consistent abnormal returns impossible for the

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Pant and Bishnoi (2001) tested the random walk hypothesis using Nifty, NSE-50, Sensex, BSE-100 and BSE-200 during the period April 1996 to June 2001. The unit root test strongly accepted the null hypothesis of random walk for all the indices, whereas it was rejected using heteroscedasticity corrected variance ratio test. The study also showed that there were significant first order autocorrelation in daily returns, which are in general absent in weekly returns. **Samanta (2004)** carried out spectral shape tests for daily data on the BSE-100 from January 1993 to December 2001. 2001. He partitioned the entire period into 18 sub-periods and tested separately for each sub-period. The study showed that the market was considerably inefficient during each sub-period till June 1996. It achieved a high level of efficiency during July 1996 to December 1999 and showed efficiency at a relatively lower level thereafter, except with some aberration during 2000. **Ahmad, Ashraf and Ahmed (2006)** attempted to seek evidence for the weak form market hypothesis using the daily data for stock indices of the NSE, nifty and BSE, Sensex, for the period of 1999-2004. They found that the random walk hypothesis foe the nifty and the Sensex stock indices is rejected.

RESEARCH METHODOLOGY

This research paper is based on secondary data, which consist of daily closing prices from NSE's S&P CNX Nifty and NASDAQ's NASDAQ Composite. In order to observe the impact of the recent financial crisis, the period of data collection has been kept from 1st January 2008 to 31st December 2010. The data has been collected from the websites of NSE and yahoo finance.

For the purpose of this study, following hypotheses are framed:

H_{01} = Stock market prices under the study are not normally distributed.

H_{02} = Stock market returns under the study follow a random walk.

H_{03} = Stock markets under the study are weak form efficient.

The normality of the time series data has been analyzed using the Jarque - Bera test, and the randomness was examined using Autocorrelation function.

DATA ANALYSIS AND EMPIRICAL RESULTS

1.   Descriptive Statistics

The descriptive statistics describes the characteristics of the data as the outline of descriptive statistics, which is provided in table 1. The sample means, median, maximum, standard deviation, skewness, kurtosis, Jarque-Bera statistics and

probability values are given hereunder.

Table 1: Descriptive Statistics

	NSE	NASDAQ
Mean	0.000303	-3.03E-07
Median	-0.000765	-0.000869
Maximum	1.729047	0.095877
Minimum	-1.783025	-0.116998
Standard Deviation	0.128877	0.020986
Skewness	-0.747565	-0.107588
Kurtosis	99.03631	7.888237
Jarque-Bera	282522.0	733.1981
Probability	0.000000	0.000000
Observations	735	735

Source: Author's Calculations

From table 1, it can be seen that NASDAQ has the higher value in terms of mean and median. But maximum price and minimum price is higher in case of NSE. The standard deviation values are lower in case of NASDAQ. The higher value of standard deviation for NSE explains that the NSE is more volatile market as compared to NASDAQ. The values of skewness and kurtosis reveal that both markets do not follow a normal distribution, which is further verified by the value of the Jarque-Bera statistic and probability value.
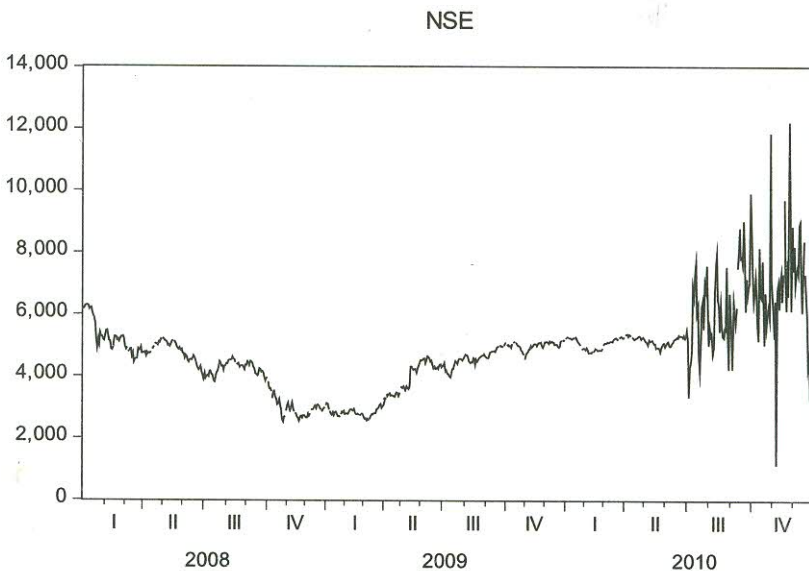

Figure 1

NASDAQ

Figure 2

Figure 1 and Figure 2 represents the time plots of the NSE and NASDAQ price series respectively, which fluctuates on a daily basis. From these figures, it can be clearly seen that the prices of both the markets follow almost similar movements and a similar trend. It can be noticed that both the markets have suffered a downfall during the period of July 2008 to December 2008, the period of the recent financial crisis. But both the market trends upward after December 2008 and after that headed toward growth again, which was a transition period after the recent financial crisis. The fluctuations in the NSE prices are more as compared to NASDAQ which proves that NSE is more volatile as compared to NASDAQ.
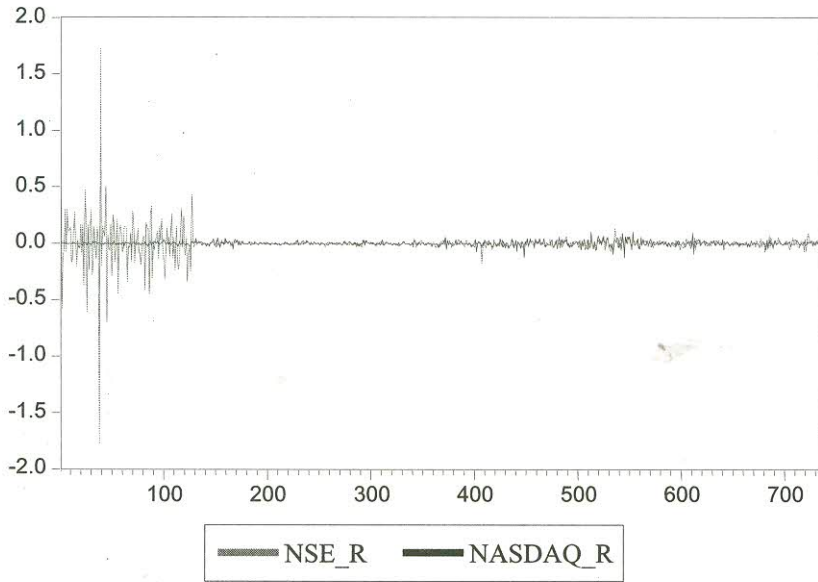
Figure 3

Figure 3 represents the comparative returns from both the markets i.e. NSE and NASDAQ go head and head most of the time, but it can be seen in 2008 NSE remain more volatile than NASDAQ.

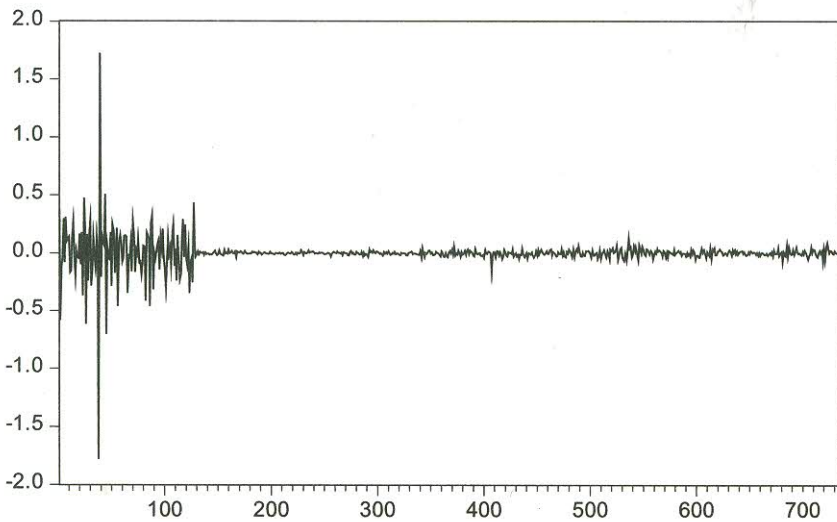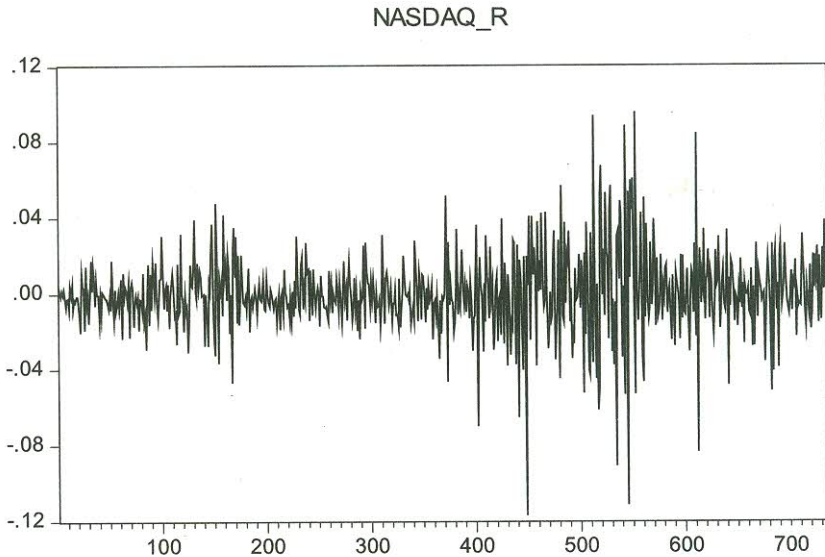**Figure 4**

NASDAQ_R

Figure 5

Figure 4 and Figure 5 display the trend of returns of share prices indices for both NSE and NASDAQ respectively. The returns considered here are the first difference of the natural logarithm of price series. The NSE was found to be volatile during the period of financial crisis i.e. Around the middle of 2008, whereas, NASDAQ was consistently volatile but the volatility has increased during July 2008 to July 2009.

2.   Autocorrelation Function

The Autocorrelation Function (ACF) is used to determine the independence of stock price changes. It measures the amount of linear dependence between observations in time series that are separated by lag. The Ljung-Box (Q) statistic is used to test whether a group of autocorrelations is different from zero. The ACF and Q-statistic of NSE and NASDAQ for are presented in table 2 here under

Table 2: Autocorrelation Function

Lags	NSE		NASDAQ	
	ACF	Ljung-Box	ACF	Ljung-Box
1	-0.40792*	122.8	-0.1461*	15.75383
2	-0.03823	123.8803	-0.08131	20.64012
3	0.042786	125.235	0.054996*	22.87834
4	-0.06506*	128.3719	0.011543	22.97708
5	0.081516*	133.3027	0.003396	22.98564

6	-0.18753*	159.4349	-0.05516*	25.24635
7	0.090771*	165.5658	0.081742*	30.21819
8	-0.07755*	170.047	-0.02895	30.84275
9	0.042008	171.3637	-0.02297	31.23639
10	0.112365*	180.7973	0.041387	32.51618
11	-0.08927*	186.7599	0.012578	32.63455
12	0.150125*	203.6459	-0.00427	32.64821
13	-0.12742*	215.8277	-0.04264	34.01249
14	-0.06095*	218.619	0.029968	34.68723
15	0.155344*	236.7746	0.114908*	44.62122
16	-0.09952*	244.2366	-0.10934	53.6277
17	-0.01909	244.5115	-0.00425	53.64135
18	-0.07025*	248.2402	0.069956*	57.3387
19	0.113546*	257.9943	-0.0404	58.57365
20	0.020973	258.3275	-0.00748	58.61607
21	-0.08189*	263.4149	-0.04646	60.25375
22	0.077269*	267.9508	0.027534	60.82974
23	-0.04396	269.421	0.005593	60.85354
24	0.047052	271.1077	0.076529*	65.31559
25	-0.00976	271.1803	0.057577*	67.84482
26	-0.05606*	273.5811	-0.03174	68.61446
27	0.017508	273.8156	-0.03659	69.63876
28	-0.06168*	276.7306	0.07094*	73.49463
29	0.079776*	281.6137	0.012869	73.62171
30	-0.02051	281.937	-0.03321	74.46919
31	-0.03187	282.7185	0.048125	76.25128
32	0.024712	283.1891	-0.02616	76.77846
33	-0.05544*	285.5604	-0.00201	76.78159
34	0.109824*	294.8808	0.001682	76.78378
35	-0.01116	294.9771	-0.00747	76.82697
36	0.069627*	298.7341	-0.05036	78.79224
37	-0.1182*	309.5773	0.00852	78.84857
38	-0.00768	309.6231	0.050684	80.84505
39	0.018826	309.899	0.016926	81.06803
40	-0.02636	310.4405	0.006382	81.09978

*Significant at two standard errors at the 1 percent level of significance.
Source: Author's Calculations

The values of ACF presented in table 2, the values for NSE are found significant at all the lags except 2,3,9,17,20, 23,24,25,27,30,31,32,35,38,39 and 40 during the period under study. Ljung-Box or Q statistic also rejects the null hypothesis of zero autocorrelation at the 1 percent level of significance. The behavior of the NASDAQ during this period of found to be better as compared to NSE because ACFs are significant at lags 1, 3, 6,7,15,18,24,25 and 28 and the Q test also rejects the null hypothesis of zero autocorrelation at the 1 percent level of significance. Therefore, the ACFs for NSE and NASDAQ are highly autocorrelated and it can be concluded that both NSE and NASDAQ, both are considered to inefficient markets during the period under study.

CONCLUDING REMARK

It can be inferred from the Jarque-Bera statistics contained in descriptive statistics that the hypothesis of normal distribution is rejected at the conventional 5 percent level. Apart from this, it can be seen from the results of autocorrelation function that the null hypothesis random walk and weak form efficiency is rejected in case of both NSE and NASDAQ. This suggests that the NSE and NASDAQ do not the characteristics of random walk and thus these markets are not efficient in the weak form implying that stock prices remain predictable.

The empirical results do not support the validity of weak-form efficiency for stock market returns of Indian and USA stock exchanges. This implies that the Indian and USA stock markets are not weak form efficient indicating that there is systematic way to take advantage of the trading opportunities and earn abnormal returns. This also provides an opportunity to the traders for predicting the future prices and receiving excess profits.

As far as the implication of rejection of weak form efficiency are concerned for the investors, they can better predict the stock price movements, by holding a well diversified portfolio while investing in the Indian and USA stock markets.

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