An Analysis of Market Efficiency in Sectoral Indices: A Study with a Special Reference to Bombay Stock Exchange in India

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Abstract

The Sectoral Index Analysis of Stock Exchange is also one way of measuring the economic growth. It quantifies the key parameters of economy growth of a country. Further, the analysis of different indices facilitates the Government and Investors to use it as the reference guide. This Paper proposes to test the sectoral indices of BSE and to examine the market efficiency by using the Runs Test and Autocorrelation Test. The study found that the returns of BSE Automobile Index, BSE Bankex, BSE Capital Goods Index,

BSE Health Care Index, BSE Metal Index, BSE PSU Index and BSE Realty Index were significant at 5% level during the study period.

Keywords: Market Efficiency, Sectoral Indices, Runs Test, Autocorrelation Test

1. Introduction

A Stock Exchange provides a platform to trade equity stocks and other securities. It also provides facilities for the issue and redemption of securities as well as other financial instruments. The securities traded on a stock exchange include shares issued by companies, indices, pooled investment products and bonds. There are 23 stock exchanges which include two primary entities, BSE and NSE and 21 other regional exchanges. The BSE and NSE are the most influential Stock Exchanges in India. The Bombay Stock Exchange Limited, often referred to as the BSE, was originally established in 1875. BSE is the Oldest Stock Market in the entire Asian Continent. The National Stock Exchange of India was originally established in the City of Mumbai in 1992. NSE is mutually-owned by a set of leading financial institutions, banks, insurance companies and other financial intermediaries in India but its ownership and management operate as separate entities.

1.1. Sectoral Analysis of Index

The sectoral analysis is typically employed by investors who plan to select better stocks to invest in. The investors normally identify the most promising sectors and review the performance of companies within the sector to determine which individual stock would provide better returns and purchase such stocks. The Sectoral Efficiency (market) is an important concept which helps to understand the working of capital markets. The term, Market Efficiency, explains the relationship between information and share prices. The Market Efficiency influences the investment strategy of investors because in an Efficient Market, there will be no undervalued or overvalued stocks. This implies that the stocks will not offer return higher than expected returns at a given risk. On the other hand, if the market is not efficient, the excess returns could be made by correctly picking the stocks. In this study, an analysis of stock prices of Sectoral Indices in the Bombay Stock Exchange (BSE) was carried out to test the market efficiency of Indian Stock Market. A Capital Market is deemed to be efficient with respect to an information item if the prices of securities fully share price returns implications.

This study focuses on BSE Sectoral Indices. India has 13 Indices as on 30th April 2011 and each index contains many companies. Every index is important. Investors, Stakeholders and Policy Makers invest the money in stock market, especially in sectoral indices, and gain more profits. The sectoral analysis of this Study covers market efficiency of different sectors (Sectoral Index) of the economy. The BSE Sectoral Indices are considered important and therefore, this paper tests the market efficiency across the Sectoral Indices listed at the BSE using daily Index Returns.

2. Review of Literature

The studies already conducted in the sector analysis in different periods are summarized below.

Anand Pandey (2003) tested the efficiency level of the three popular stock Indices of Indian Stock Market using the Runs Test and the Autocorrelation Function of ACF. It is found from the Autocorrelation and Runs Test that the time series of stock indices in the Indian Stock Market were biased random time series.

Kin-Yip Ho and Albert K C Tsui (2004) probed the applicability of volatility behavior of aggregate indices to the sectoral indices. The study doubted the leverage effects of equity returns and also it's bearing on the strategy of portfolio diversification among various sectors.

Tasneem Alam and Muhammad Waheed (2004) investigated the monetary transmission mechanism in Pakistan at the sectoral level. The study assessed whether the reform process achieved notable impact on the monetary transmission mechanism or not. The study found that there was significant changes in the transmission of monetary stock to real sector of the economy during the post-reform period.

Mufeed Rawashdeh and Jay Squalli (2004) tested market efficiency across the four sectors, namely, Banking, Industrial, Insurances and Services in the Amman Stock Exchange (ASE). The study found that the random walk and weak form efficiency hypotheses were rejected for all sample sectors. Besides, the returns of mean values were highly volatile and over inflated stock prices and frequent market corrections formed a bubble effect. It indicates that investment in all sectors of the ASE may be very risky in the short run.

Chin Wen Cheog (2008) investigated the weak form market efficiency by using daily return of nine sectoral indices in Malaysian Stock Market. These empirical results were in sharp contrast with the traditional unit root test which ignored the economic crisis and currency control. The study found that the sectoral indices of Malaysian Stock Markets were inefficient weak-form (except the property index).

Natarajan. P and Dharani.M (2010), investigated the efficiency of Nifty Benchmark Schemes by using Alpha and Beta Co-efficient. The study found that the Nifty BeEs over performed in relation to the Nifty Index.

Selvam.M, Indhumathi.G and Rajesh Ramkumar.R studied the market efficiency of the sample companies listed on the BSE PSU Index. The study found that the PSU Index performed well during the study period and the investors of PSU companies earned maximum return through stock market operations.

The above literature provides an overview of different models used to study the sectoral efficiency. There was no comprehensive study carried out in Indian Stock Markets. Thus an attempt has been made in this study to evaluate market efficiency in the Indian Context, taking the models used in the above studies.

3. Statement of the Problem

The Capital Market is a vital institution as it facilitates economic development. It is true that so many parties are interested in knowing the efficiency of the Capital Market. The small and medium investors could be motivated to save and invest in the capital market only if their securities in the market are appropriately priced. But many did not know how to invest the money in correct indices in the Indian Share Market. Besides, the investors do not have any idea about which company and which indices are best in India. The previous studies tested the efficiency in the global stock market, namely, Ghana Stock Market, Palestinian Stock Market, Russian Stock Market and also tested the random walk for various popular indices. But in India, few studies have examined the daily returns, weekly returns and monthly returns of the stock market in particular stock indices, like S&P CNX Nifty, BSE 100 Index, and Nifty Junior etc. It is to be noted that no researcher has used the index returns in previous studies. So the main problem of the investors is that they do not know how to invest the money in performing indices. Besides, there was no comprehensive study carried out to test the efficiency of the different sectors and sectoral indices of a stock exchange in the Indian Context. Hence, the present study proposes to investigate the efficiency of Sectoral Indices, taking most actively traded indices in the Bombay Stock Exchange (BSE) and using the Index Returns.

4. Objectives of the Study

The main aim of the study is to examine the market efficiency of the sectoral indices listed in BSE India.

5. Hypotheses of the Study

The present study tests the following null hypotheses.

NH1: There is no normal distribution in the returns of the Sectoral Indices in BSE.

NH2: There is no significant difference in the returns of the Sectoral Indices in BSE.

6. Methodology of the Study

6.1. Selection of the Sample

The study attempts to test the behavior of Sectoral Indices in Daily Index Returns. The sample indices were taken from BSE Sectoral Indices. There are a total of 13 Indices listed in BSE as on April 2011. As the required information was available for only 12 Indices, the study covered only 12 Indices. The details of sample indices are given in **Table-1.**

Table 1:   List of Indices in Bombay Stock Exchange Sectoral Indices

Sl.No	Name of the Indices
1	BSE Auto Index
2	BSE Bankex
3	BSE Consumer Durables
4	BSE Capital Goods
5	BSE Fast Moving Consumer Goods
6	BSE Health Care Index
7	BSE Information Technology Index
8	BSE Metal Index
9	BSE Oil and Gas Index
10	BSE PSU Index
11	BSE Realty Index
12	BSE TECk Index.

Source: www.bseindia.com.

6.2. Source and Collection of Data

The study mainly depends on secondary data. The required data regarding daily index returns of BSE Sectoral Indices were collected from the CMIE Prowess Corporate Database and www.bseindia.com. The other required data were collected from various books, journals and magazines.

6. 3. Period of the Study

The study analyzed the Daily Index Returns of Efficiency of Sectoral Indices listed in BSE for six years from 1st January 2005 to 31st December 2010.

6.4. Tools Used for Analysis

For the purpose of analysis of Sectoral Indices in Indian Stock Market, the following tools were used.

(a) Runs Test

It is used for measuring market performance. It does not require specification of the probability distribution. It depends only on the share price. It is essentially concerned with direction of changes in price. The following formula is used.

$$M = \frac{N(N+1) - \sum_{i-1}^{3} n_i^2}{N}$$

M is Expected number of runs, **ni** is Number of price changes of each sign (i=1,2,3) and **N** is Total number of price changes.

(b) Autocorrelation
It is the statistical tool used for measuring the indices successive terms in given time series and dependence of the successive share price changes.

$$P_k = \frac{\sum_{t=1}^{n-k}(R_t - \overline{R})(R_{t+k} - \overline{R})}{\sum_{t=1}^{n}(R_t - \overline{R})^2}$$

K is the Number of lags, **Rt** represents the real rate of return, **n** is the total number of observations, and **Pk** is the sample Autocorrelation function for the lag K

7. Limitations of the Study
The study suffers from the following limitations.
1. The study was based on secondary data, and hence it is riddled with certain limitations, which are bound to be connected with secondary data.
2. This study focused only on 12 BSE Sectoral Indices.
3. The study period covered only six years from 2005 to 2010.
4. All the limitations associated with various tools like Runs Test and Autocorrelation Test are applicable to this study also.

8. Analysis of Market Efficiency (Sectoral Indices) of BSE
The analysis of market efficiency is arranged as follows.
   8.1. Analysis of Market Efficiency - Runs Test
   8.2. Analysis of Market Efficiency – Autocorrelation

8.1. Analysis of Market Efficiency in Runs Test

Table-2 shows the results of Runs Test by considering mean value as the base for BSE Sectoral Indices. From the above Table, it is clearly understood that out of 12 Indices, only seven Indices in the BSE Sectoral Indices, namely, BSE Automobile Index, BSE Bankex, BSE Capital Goods Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index and BSE Realty Index followed the normal distribution. The high Z values are BSE Automobile Index (-2.422), BSE Bankex (-4.111), BSE Capital Goods Index (-4.213), BSE Health Care Index (-3.304), BSE Metal Index (-2.785), BSE PSU Index (-3.697), and BSE Realty Index (-5.259). It is to be noted that the Z values of these Indices were significant under normal distribution at 5% level. The remaining 5 Indices earned low Z value and those indices are BSE Consumer Durables Index (-1.354), BSE FMCG Index (1.425), BSE Information Technology Index (-1.458), BSE Oil & Gas Index (-0.907) and BSE TECk Index (-0.693). These five indices did not follow normal distribution as its mean values were not significant. Therefore, the Null Hypothesis **(NH1), "There is no normal distribution in the returns of the BSE Sectoral Indices"** is partially rejected. The retails investors should note these facts and keep them in mind before investing their money in these indices.

In the light of the above findings, it is suggested to the investors that they could invest among the best sectoral indices. The best indices are BSE Automobile Index, BSE Bankex, BSE Capital Goods Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index and BSE Realty Index that followed normal distribution at 5 percent level. Hence investors may get better return on the above indices.

Table 2:   Results of Runs Test with Mean Base for Bombay Stock Exchange Sectoral Indices

Indices Name	Z	Significant value
BSE Auto index	-2.422	.015*
BSE Bankex	-4.111	.000*
BSE Capital Goods Index	-4.213	.000*
BSE Consumer Durable Index	-1.354	.176
BSE FMCG Index	-1.425	.154
BSE Health Care Index	-3.034	.002*
BSE Information Technology Index	-1.458	.145
BSE Metal Index	-2.785	.005*
BSE Oil and Gas Index	-.907	.365
BSE PSU Index	-3.697	.000*
BSE Realty Index	-5.259	.000*
BSE TECk Index.	-.693	.480

Source: Computed from Prowess.
Note: Significant Value at 5 percent level.

The results of Runs Test by having median as the base for BSE Sectoral Indices are given in **Table-3**. It is clear that four Indices out of 12 sample Sectoral Indices in the BSE did not follow the normal distribution. They are BSE FMCG Index (0.154), BSE IT Index (0.204), BSE Oil and Gas Index (0.365) and BSE TECk Index (0.776). The Z values of these indices are BSE FMCG Index (-1.475), BSE Information Technology Index (-1.269) BSE Oil & Gas Index (-0.907) and BSE TECk Index (-0.285). Besides, the Z values of remaining four indices were not significant under the normal distribution at 5 percent level. From the analysis, it is noted that Z values of eight Indices were significant at 5 percent. They are BSE Automobile Index (-2.668), BSE Bankex (-4.015), BSE Capital Goods Index (-2.046), BSE Consumer Durables Index, BSE Health Care Index (-2.876), BSE Metal Index (-3.186), BSE PSU Index (-3.601) and BSE Realty Index (-5.259). Hence the Null Hypothesis **(NH1)**, **"There is no normal distribution in the returns of the BSE Sectoral Indices"** is partially rejected under the median base analysis. Investors are advised to invest in these Indices (BSE Auto Index, BSE Bankex, BSE Capital Goods Index, BSE Consumer Durables Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index and BSE Realty Index) to earn good return. The above Indices were significant at 5 percent level and these Indices performed well.

The result of Runs Test for median base reveals the fact that 8 indices among the 12 indices attained normal distribution at 5 percent level during the study period. It is suggested that the investors can invest in the above 8 indices to get maximum return.

Table 3:   Runs Test Analysis with Median Base for Bombay Stock Exchange Sectoral Indices

Indices Name	Z	Significant value
BSE Auto index	-2.668	.008*
BSE Bankex	-4.015	.000*
BSE Capital Goods Index	-4.119	.000*
BSE Consumer Durable Index	-2.046	.041*
BSE FMCG Index	-1.475	.154
BSE Health Care Index	-2.876	.004*
BSE Information Technology Index	-1.269	.204
BSE Metal Index	-3.186	.005*
BSE Oil and Gas Index	-.907	.365
BSE PSU Index	-3.601	.000*
BSE Realty Index	-5.259	.000*
BSE TECk Index.	-.285	.776

Source: Computed from Prowess.
Note: Significant Value at 5 percent level.

8.2. Analysis of Market Efficiency in Autocorrelation

Table- 4 reveals the result of autocorrelation for BSE Sectoral Indices during the study period from 2005 to 2010. It is understood from the above Table that out of 12 Indices taken for this study, only eight Indices earned significant value in all the lags. These Indices are BSE Automobile Index, BSE Bankex, BSE Capital Goods Index, BSE Consumer Durables Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index and BSE Realty Index. Further, it is to be noted that the value of these eight Indices were significant at 5 percent level. The analysis shows that two Indices namely, BSE IT Index (.519) and BSE Oil and Gas Index (.060) did not follow at 5 percent significant level. But these two indices were significant at 5 percent level for remaining nine lags. The analysis of autocorrelation reveals the fact that these two Indices, namely, BSE FMCG Index and BSE TECk Index, did not earn significant value at 5 percent level in all the lags. Hence the Null Hypotheses **(NH2)** namely, **"There is no significant difference in the returns of BSE Sectoral Indices"** is rejected for ten Indices like BSE Automobile Index, BSE Bankex, BSE Capital Goods index, BSE Consumer Durables, BSE Health Care Index, BSE IT Index, BSE Metal Index, BSE Oil & Gas Index, BSE PSU Index and BSE Realty Index. The above null hypothesis is accepted for other two Indices, namely, BSE FMCG Index and BSE TECk Index during the study period.

The analysis of autocorrelation for BSE 12 sectoral indices shows that ten indices were significant at 5 percent level. It is suggested that the investor may invest the money in the highly performing indices like BSE Automobile Index, BSE Bankex, BSE Capital Goods index, BSE Consumer Durables, BSE Health Care Index, BSE IT Index, BSE Metal Index, BSE Oil & Gas Index, BSE PSU Index and BSE Realty Index and earn higher return definitely.

Table 4:   Autocorrelation Results for Bombay Stock Exchange Sectoral Indices during the study period

Name of the Indices	Lag1	Lag2	Lag3	Lag4	Lag5	Lag6	Lag7	Lag8	Lag9	Lag10
BSE Auto*	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
BSE Bankex*	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
BSE CG*	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
BSE CD*	.000	.000	.000	.000	.000	.000	.000	.001	.001	.002
BSE FMCG	.433	.469	.565	.706	.731	.826	.687	.780	.840	.849
BSE HC*	.001	.001	.002	.005	.010	.009	.003	.004	.007	.006
BSE IT	.519	.002	.001	.001	.003	.007	.007	.009	.015	.018
BSE Metal*	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
BSE Oil& Gas	.018	.060	.035	.046	.043	.045	.016	.001	.002	.004
BSE PSU*	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
BSE Realty*	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
BSE TECk	.365	.006	.012	.013	.026	.032	.040	.026	.032	.033

Source: Computed from Prowess.

9. Conclusion

The study analyzed the market efficiency of Sectoral Indices listed in BSE. It is found that the returns of 8 indices out of 12 Indices, namely, BSE Automobile Index, BSE Bankex, BSE Capital Goods Index, BSE Consumer Durables Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index, and BSE Realty Index followed normal distribution and earned better return at 5 percent significant level. It shows that these 8 Indices performed well.

10. Scope for Further Research
- BSE Midcap Indices, Small Cap Indices BSE 100, BSE200, BSE 500 also could be taken up for further research.
- The NSE market could be taken up further studies.

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