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VOLATILITY OF THE INDIAN SECTORAL INDICES - A STUDY WITH REFERENCE TO NATIONAL STOCK EXCHANGE

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ABSTRACT

The Sector-based index is designed to provide a single value for the aggregate performance of a number of companies representing a sector of the economy. This study is an attempt to provide an empirical support to identify the risk factors in sectoral indices and CNX Nifty index and also to see the risk relationship in different time intervals. The indices selected for the study are CNX Nifty index, CNX Auto index, CNX Bank index, CNX FMCG index, CNX Infrastructure index and CNX Information Technology index for the period from 01/01/2004 to 30/04/2012. The data has been taken from the official website of National stock exchange. Two sample T-Test and One – way ANOVA between subjects has been used to identify the risk factor difference across the risk of sectoral indices and CNX Nifty index. The results show that there is no difference in the Standard deviation among various sectoral indices. The One-way ANOVA within groups has been used to identify, if there is any difference in the risk across time intervals. The results show that there is a significant difference in the mean scores of various time intervals. The results exhibit important implications to individual investors and portfolio managers in terms of reducing portfolio risk and enhancing their returns.

KEY WORDS: ANOVA, T-Test, Nifty & sectoral indices.

Introduction

From the beginning of the 1990s in India, a number of measures have been taken for economic liberalization. At the same time, large number of steps has been taken to strengthen the stock market such as opening of the stock markets to international investors, regulations, increased power of SEBI and trading activities in derivatives. These measures have resulted in significant improvements in the size and depth of stock markets in India and they started to play their due role. (Shahid Ahmed, 2008) Understanding dynamics of Indian stock market may be useful for traders, investors and policy makers. The Securities Contract (Regulation) Act has defined stock exchange as an "association, organization, or body of individuals, whether incorporated or not, established for the purpose of assisting, regulating and controlling business of buying, selling and dealing in securities". The sector-based index is designed to provide a single value for the aggregate performance of a number of companies representing a group of related industries or within a sector of the economy. The index is based on a statistical compilation of the share prices of a number of representative stocks. It

also creates the basis for portfolio trading by both active and passive investors. These market indices are convenient gauges of the stock market that also indicate the direction of the market over a period of time. By using these market indices, you can compare how well individual stocks and mutual funds have performed against market indicators for the same period.

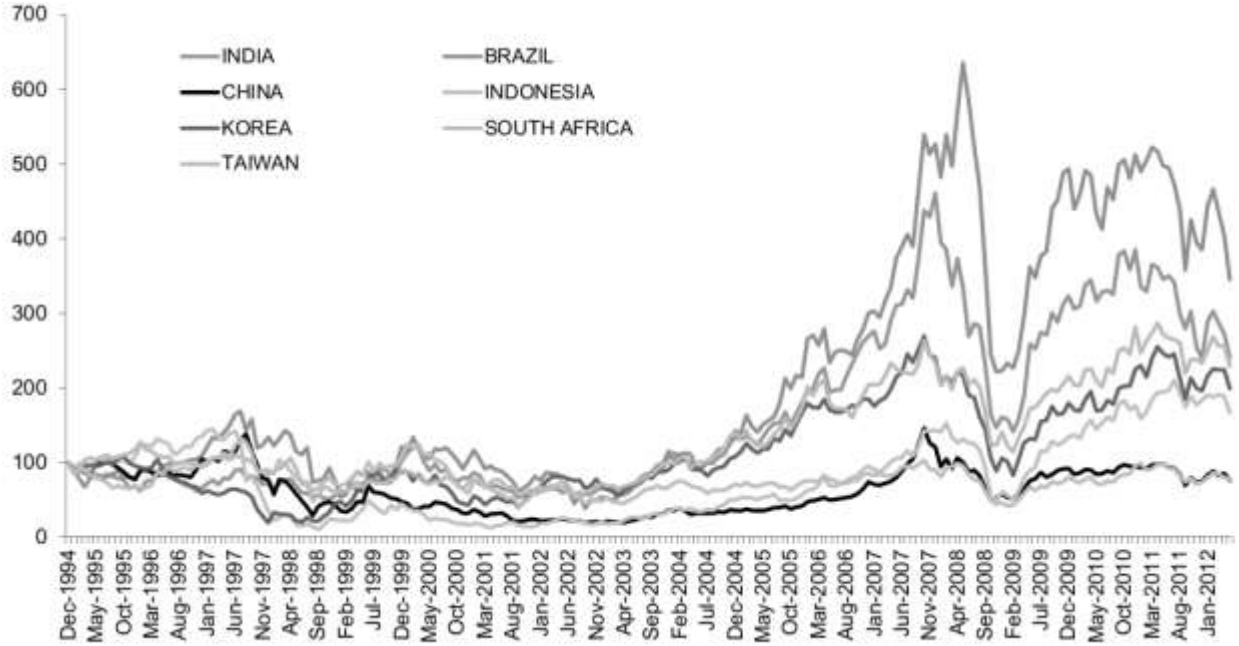
Importance of the Stock index

First, the market indices provide an historical perspective of stock market performance, giving investors more insight into their investment decisions. Investors who do not have much knowledge about individual stocks to invest they can use indexing as a method of choosing their stock investments.

The second benefit of stock market indices are that they provide a yardstick with which investors can compare the performance of their individual stock portfolios. Individual investors with professionally managed portfolios can use the indices to determine how well their managers are doing in managing their money.

The third major use of stock market indices are as a forecasting tool. Studying the historical performance of the stock market indices, you can forecast trends in the market.

Graph: 1 Performances of World equity market indices



Source: Bloomberg data base

According to Morgan Stanley Capital International (MSCI), Indian equity market has been the best performing markets in comparison with world market and also Indian equities have delivered a Compounded Annual Growth Rate (CAGR) of 14% over the last two decades.

The National Stock Exchange of India

The National Stock Exchange of India was promoted by leading financial institutions at the behest of the government of India, and was incorporated in November 1992 as a tax-paying company. In April 1993, it was recognized as a stock exchange under the Securities Contracts (Regulation) Act, 1956. The S & P CNX Nifty was launched on 3rd November, 1995 with a base value of 1000. S&P CNX Nifty is a leading stock market index of India that

captures the share price behavior of a portfolio of 50 blue chips, large companies which are the most liquid in the market. It provides National Exchange for Automated Trading [NEAT] ensuring high degree of transparency and equal access to investors as well. It is widely believed that the standards set by the NSE in terms of market practices, products, technology and service standards have become the benchmarks for the industry and many exchanges are replicating the practices adopted by the NSE. The National Stock Exchange has been ranked 11th in the world on the basis of market capitalization (1,178 USD Billions) as on 31st October 2012 and ranked world's 16th largest stock exchange in terms of value traded (422 USD Billions) as on 31st October 2012. NSE covers more than 330 cities across the country and has its terminals located at 1486 locations all over India. The NSE provides access to different types of investors from all the nook and corners of India.

Fig:1 Volatility of NSE Nifty and world stock market indices

Figure 1 shows the volatility of CNX Nifty and leading world stock market indices. It is clearly depicted that CNX Nifty 50 is less volatile during the Global financial crisis and quick recovery after crisis when compare to Dow Jones (U.S), Nasdaq (America), FTSE 100 (London), Nikkie 225 (Toyko) and Hangseng (Hong Kong).

Sectoral indices selected for the study:

CNX FMCG index:

FMCGs (Fast Moving Consumer Goods) are those goods and products, which are non-durable, mass consumption products and available off the shelf. The CNX FMCG index comprises of 15 companies who manufacture such products which are listed on the National Stock Exchange (NSE). This index also computed using free float market capitalization method with base period of 1st January, 1996 to a base value of 1000. The Free float methodology of market capitalization is calculated by taking the equity's price and multiplying it by the number of shares readily available in the market. It excludes locked-in shares such as those held by promoters and governments. It will be calculated as follows,

$$FFM = Share\ Price \times (\#\ Shares\ Outstanding - Locked\ In\ Shares)$$

The free float method is seen as a better way of calculating market capitalization because it provides a more accurate reflection of market movements. Free float methodology has been adopted by most of the world's major indexes, including the Dow Jones Industrial Average and the S&P 500. All the indices selected for the study are based on free float methodology.

CNX IT index:

Information Technology (IT) industry has played a major role in the Indian economy during the last few years. A number of large, profitable Indian companies today belong to the IT sector and a great deal of investment interest is now focused on the IT sector. Companies in this index are those that have more than 50% of their turnover from IT related activities like IT Infrastructure, IT Education and Software Training, Telecommunication Services and Networking Infrastructure, Software Development, Hardware Manufacturer's, Vending, Support and Maintenance. The CNX IT index consists of 20 companies based on free float market capitalization method with a base date of 1st January, 1996. The base value of index has started with 1000 and it was revised to 100 with effect from 28th May, 2004.

CNX Bank index:

The Indian banking Industry has been undergoing major changes, reflecting a number of underlying developments. CNX Bank index is an index comprised of the most liquid and large capitalized Indian banking stocks. It provides investors and market intermediaries with a benchmark that captures the capital market performance of Indian banks. The index has 12 stocks from the banking sector which trade on the National Stock Exchange. CNX Bank index has started in 1st January, 2000 using free float market capitalization method with base value of 1000.

CNX Infrastructure index:

CNX Infrastructure index includes companies belonging to Telecom, Power, Port, Air, Roads, Railways, shipping and other Utility services providers. It is well recognized that quality infrastructure is one of the most important necessities for unleashing high and sustained growth. Government outlay for infrastructure has increased significantly over the years. Recognizing the needs of the market, India Index Services & Products Limited (IISL) has developed CNX Infrastructure index to capture the performance of the companies in the infrastructure sector. The CNX Infrastructure index has started on 1st January, 2004 with a base value of 1000. Final selection of 25 companies included in the index based on free float market capitalization weighted method.

CNX Auto index:

The CNX Auto index is designed to reflect the behaviour and performance of the automobiles sector which includes manufacturers of cars & motorcycles, heavy vehicles, auto ancillaries, tyres, etc., The CNX Auto index comprises of 15 stocks that are listed on the National Stock Exchange. The CNX Auto index has started in 1st January, 2004 using free float market capitalization method with a base value of 1000, wherein the level of the index reflects the total free float market value of all the stocks in the index relative to particular base market capitalization value.

Table: 1 Details of sectoral indices selected for the study

Index	Date of implementation	Base value	No of companies included in the index	No. of Companies included in the CNX Nifty index	Proposition With CNX Nifty index
CNX Nifty index	3rd Nov. 1995	1000	50	-	-
CNX FMCG index	1st Jan 1996	1000	15	2	4%
CNX IT index	1st Jan 1996	100	20	4	8%
CNX Bank index	1st Jan 2000	1000	12	7	14%
CNX Infra index	1st Jan 2004	1000	25	9	18%
CNX Auto index	1st Jan 2004	1000	15	5	10%
			Total	27	54%

Fig: 2 The daily closing values of NSE Nifty and sectoral indices

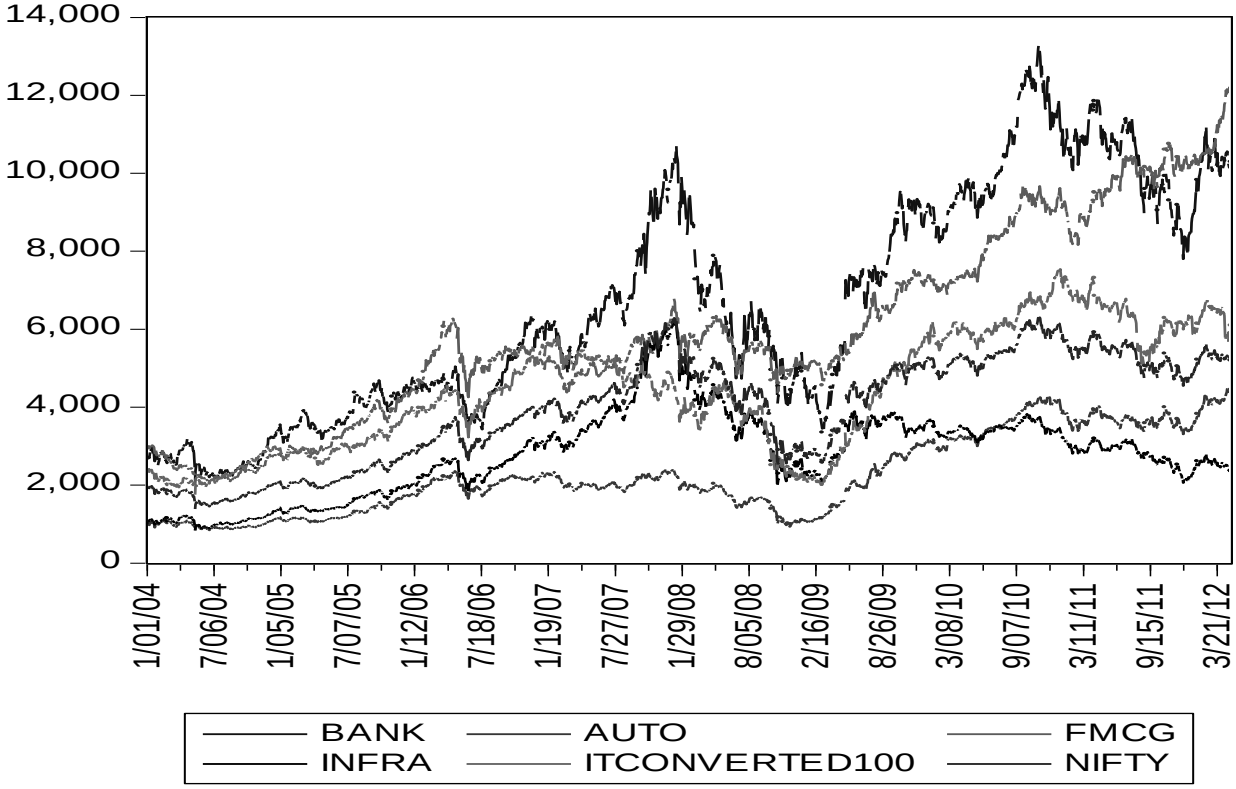


Figure 2 shows the daily closing index values of various indices starting from 1st January 2004 to 30th April 2012 (8 years). These indices are CNX Nifty, CNX Bank, CNX Auto, CNX FMCG, CNX Infrastructure and CNX Information Technology. The CNX Information Technology index has the high volatile when compared to all other indices.

Review of Literature:

Several studies have been conducted to examine the risk factors on the stock indices. **Poshakwale Sunil (2002)** examined the random walk hypothesis in the emerging Indian stock market by testing for the nonlinear dependence using a large disaggregated daily data from the Indian stock market. The sample used was 38 actively traded stocks in the BSE National index. He found that the daily returns from the Indian stock market do not conform

to a random walk. Daily returns from most individual stocks and the equally weighted portfolio exhibit significant non-linear dependence. This is largely consistent with previous research that has shown evidence of non-linear dependence in returns from the stock market indices and individual stocks in the US and UK. **Yakob, Beal and Delpachitra (2005)** examined seasonal effects of ten Asian Pacific stock markets, including the Indian stock market, for the period January 2000 to March 2005. They stated that this is a period of stability and therefore ideal for examining seasonality as it was not influenced by the Asian financial crisis of the late nineties. Yakob, et al., concluded that the Indian stock market exhibited a month-of-the-year effect in that statistically significant negative returns were found in March and April whereas statistically significant positive returns were found in May, November and December. Of these five statistically significant monthly returns, November generated the highest positive returns whereas April generated the lowest negative returns. In a similar study by **Bodla and Jindal (2006)** several seasonal anomalies in the Indian stock market utilizing the S&P CNX Nifty index for the period January 1998 to August 2005. For the monthly effect, they did find some significant differences utilizing ANOVA for their sub-period, January 2002 to August 2005. However, they were unable to find any significant differences among individual months.

Rakesh Kumar and Raj S Dhankar (2011) in their article titled, "*Distribution of Risk and Return: A test of normality in Indian stock market*", examined the normality of return and risk of daily, weekly, monthly and annual returns in Indian stock market. They used parametric and non-parametric test to prove these objectives. They have selected Sensex, BSE 100 and BSE 500 indices from Bombay Stock Exchange (BSE) for the period 1996 to 2006. The results show that, the returns are negatively skewed for all the indices over the period. Asymmetry is found in risk and return in case of daily and weekly returns i.e., risk and return relationship seems inconsistent in case of daily and weekly returns. Monthly and annual return, however are found normally distributed for all three indices over the period of time. The study shows the importance of time horizon in investment strategy for the Indian stock market.

Raja sethu Durai and Saumitra N Bhadurai (2011) in their article titled, "*Correlation dynamics in Equity markets*", aimed to analyze the correlation structure of the Indian equity markets with that of world markets. The indices considered for the study are NASDAQ composite (USA), S & P 500 (USA), FTSE 100 (UK) and DAX 30 (Germany) classified as developed markets. KLSE composite (Malaysia), Jakarta composite (Indonesia), Straits times (Singapore), Seoul composite (South Korea), Nikkei (Japan), Taiwan weighted index (Taiwan) and the S & P CNX Nifty (India) are classified as Asian market, for the period 1997 to 2006. The logistic smooth transition regression (LSTR) model results for the conditional time varying correlation of S & P CNX Nifty with six Asian market and S & P CNX Nifty with four developed markets show that there is a significant regime shift in the year 2000 and there is a considerable increase in integration in the second regime. This indicates that the S & P CNX Nifty index is moving towards a better integration with other world markets but not at a very noteworthy phase.

Scope of the Study:

This study is an attempt to provide an empirical support to the risk factors across the sectoral indices and S & P CNX Nifty index. Hence, the study proposes to seek answers to the following stated questions:

- Is there any relationship across the sector in terms of risk?
- Do the time intervals influence the risk?

Objective of the Study:

1. To identify whether there is a difference in risk factors across the sectoral indices.
2. To find out if there is any difference in the risk factors among various time intervals.

Data Methodology

In order to provide more robust and updated results, this study used daily closing data of the stock indices covering a period of eight years, from 1st Jan 2004 to 30th April 2012. The data has taken from the official website of National stock exchange. The One–way ANOVA between subjects has used to identify any difference in the distribution of risk relating to various sectoral indices.

One way ANOVA within groups has used to identify if there is any difference of risk in different time intervals. The basic principle of ANOVA is to test the differences among the means of the populations by examining the amount of variation within each of these samples, relative to the amount of variation between the samples. One way ANOVA between-groups consist of different subjects or cases in each group and an independent group design. There is one factor with three or more levels (groups) and one dependent continuous variable. There is only one independent categorical variable with different subjects or cases in each of the groups. In short, the two estimates of population variance Viz., one based on between samples variance and the other based on within samples variance. Then the two estimates of population variance are compared with F-test.

$$F = \frac{\text{Estimate of population variance based on between samples variance}}{\text{Estimate of population variance based on within samples variance}}$$

Sum of Squares for variance between the samples

$$SS_{between} = n_1(X_1 - X)^2 + n_2 (X_2 - X)^2 + \ldots + n_k (X_k - X)^2$$

Mean Square between samples

$$\text{MS between} = \frac{SS_{between}}{(k-1)}$$

Where, (k-1) represents degrees fo freedom (d.f.) between samples.

Sum of squares for variance within samples

$$SS_{within} = \Sigma\left(X_{1i} - \overline{X}_1\right)^2 + \Sigma\left(X_{2i} - \overline{X}_2\right)^2 + \ldots + \Sigma\left(X_{ki} - X_k\right)^2$$

$i = 1,2,3,\ldots$

Mean Square within samples

$$\text{MS between} = \frac{SS_{within}}{(n-k)}$$

Where, (n – k) represents degrees of freedom within samples,

n = total number of items in all the samples i.e., $n_1 + n_2 + \ldots + n_k$

k = number of samples

SS for total variance = $\Sigma\left(X_{ij} - \overline{X}\right)^2$

$i = 1,2,3,\ldots.$

$j = 1,2,3,\ldots.$

SS for total variance = $SS_{between} + SS_{within}$

The degrees of freedom for total variance will be equal to the number of items in all samples minus one i.e., (n – 1). The degree of freedom for between and within must add up to the degrees of freedom for total variance i.e.,

$(n – 1) = (k – 1) + (n – k)$

F-ratio = $\frac{MS_{between}}{MS_{within}}$

Table: 2 Descriptive Statistics and Two-Sample T-Test of Sectoral indices

Index	N	Mean	Std. Dev.	Std. Error	Mini.	Maxi.	T-Value	Df	P-value
Nifty	7	.1544	.1393	.0526	.0174	.3982	-0.558	12	0.586
bank	7	.2021	.1780	.0673	.0225	.5117	-0.162	12	0.874
Auto	7	.2202	.2351	.0888	.0168	.6515	0.047	12	0.963
FMCG	7	.2155	.1176	.0444	.1059	.4027	0.187	12	0.854
Infra	7	.1992	.1971	.0745	.0199	.5725	-0.403	12	0.693
IT	7	.2444	.2217	.0838	.0277	.6194			
Total	42	.2060	.1767	.0272	.0168	.6515			

Dependent Variable: Std deviation

The descriptive statistics shows the mean and Std. deviation of each index. The CNX IT index has mean value of 0.24 & CNX Nifty index has mean value of 0.15. It shows there is no more difference in the mean values of these indices. The CNX Auto index has Standard deviation of 0.23 & CNX FMCG index has Standard deviation of 0.11. There is no wide range of risk deviation in various sector indices. The number of participants for each index is 7. The maximum and minimum values of the sectoral indices are also shown in the table No 2.

Hypothesis:

H_0 : There is no difference in the mean values of two indices.

H_1: There is a difference in the mean values of two indices.

Test: Two Sample T test

Significant level: 0.05

Conclusion: Accepted the null hypotheses stating that, there is no difference in the mean values of two indices in aspects of risk.

The result of Two Sample T test between CNX Nifty index and CNX Bank index has p-value of 0.586 ($t = -0.558$, $df = 12$, $P > 0.05$). Like the same way, CNX Bank index and CNX Auto index has p-value of 0.874($t = -0.162$, $df = 12$, $P > 0.05$), CNX Auto index and CNX FMCG index has p-value of 0.963($t = 0.047$, $df = 12$, $P > 0.05$), CNX FMCG index and CNX Infra index has p-value of 0.854 ($t = 0.187$, $df = 12$, $P > 0.05$), and CNX Infra index and CNX IT index has the p-value of 0.693 ($t = -0.403$, $df = 12$, $P > 0.05$). All these results show that p-value has greater than 0.05, it shows there is no significant difference between those indices.

Hypothesis:

H_0 : All sectoral indices have same level of risk.

H_1: At least any one of the sectoral indices has heterogeneous effect.

Test: one way ANOVA between the subjects

Significant level: 0.05

Conclusion: The null hypotheses is accepted meaning that, all sectoral indices have same level

of risk.

Table: 3 Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
1.022	5	36	.419

Table 3 shows the result of Test of Homogeneity of Variances in that Levene statistic is not statistically significant, $F(5,36) = 0.419$, ($P > 0.05$). Thus the variances equal across the sectoral indices and F-ratio can be interpreted without transformation of data.

Table: 4 ANOVA

Std deviation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.031	5	.006	.181	.968
Within Groups	1.250	36	.035		
Total	1.281	41			

Table 4 shows the results of ANOVA between groups. The F-ratio is the between groups mean square divided by the within group mean square, which gives an F ratio of 0.181 (0.006/0.035). The probability of the F-ratio is 0.968, the risk of the sectoral indices is not statistically significant ($F(5,36) = 0.181$, $p > 0.05$) thus accepting the null hypothesis and giving conclusion that there is no difference in the Std deviation across various sectoral indices.

The most important assumptions of ANOVA are independence of the groups being compared. One-way ANOVA within subjects, also known as repeated – measures ANOVA, measure the same subjects at different points of time or under different conditions, and is a dependent group design. This type of ANOVA is used when the subjects encounter repeated measures (i.e., the same subjects are used for each treatment). The participants serve as their own control because they are involved in both the treatment and control groups.

For the second objective, i.e., to find out is there any differences in the risk factor among various time intervals i.e., daily, weekly, monthly, quarterly, half-yearly and annually. The hypotheses are framed as follows,

Hypothesis:
H_0: Risk related to various time intervals is same.
H_1: At least any one of the time interval may differ from the mean value.
Test: One way ANOVA within the groups
Significant level: 0.05

Conclusion: The null hypothesis is rejected, implying, that there is a difference in the risk among various time intervals.

A one way ANOVA within subjects was conducted relating to the various time intervals i.e., daily, weekly, monthly, quarterly, half yearly and annually towards standard deviation.

Table: 5 Descriptive Statistics

	Mean	Std. Dev.
Daily	.0845	.15594
Weekly	.0718	.04814
Monthly	.1190	.01938
Quarterly	.2248	.05286
Half yearly	.3374	.08910
Annually	.5182	.11966

The table 5 shows the mean value is highest annually with a value of 0.518 whereas it is lowest weekly with a mean value of 0.071. There is no difference in the mean value of various time intervals. The daily data has the highest standard deviation of 0.155 and monthly data has the lowest standard deviation of 0.193. The number of participants for each index is 6.

Table: 6 Mauchly's Test of Sphericity[b]

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
factor1	.000	53.554	14	.000	.230	.255	.200

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.
a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.
b. Design: Intercept Within Subjects Design: factor1

Table 6 shows the results of Mauchly test of spericity. The results rejected the hypothesis (Chi-sq = 53.55, df 14, $P < 0.05$) stating that the variance are significantly different.

Table: 7 Analysis of Variance (summary)

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Time intervals	1.838	1	1.838	278.97	0.000
Error	0.033	5	0.007		

Table 7 shows the results of Analysis of Variance summary. A one-way correlated analysis of variance showed, there is significant effect on various time-intervals selected for the study ($F = 278.97$, df 1,5 $P < 0.001$) since, this value is lesser than 0.05 we would conclude that there is a significant difference in the mean scores of various time intervals.

Conclusion:

The inter-relationship among sectoral index received a substantial attention in financial literature. This study is an attempt to provide an empirical analysis to the risk-factors across the sectoral indices and CNX Nifty index. The data used for the study has daily

closing values of the stock indices covering a period of eight years, starting from 1st Jan 2004 to 30th April 2012. The two sample T- tests and one – way ANOVA between the subjects has been used to identify is there any differences in risk factor across the sectoral indices both the results show that there is no significant difference in the risk. The one-way ANOVA within the groups has used to identify is there any differences in risk by taking various time intervals and the results show that there is a significant difference of risk.

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