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Seasonal Anomalies in Indian Stock Markets

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Abstract

This paper primarily studies the possible existence of the January Effect or the Turn-Of-The-Year Effect in the Indian stock markets and the study proceeds on two propositions. First, if the January anomaly is ascribed to the tax-related selling, it should be clearly evident in the month of April in the Indian context. Second, if the phenomenon is due to some other reason then it should make itself visible in the month of January in Indian market given its interrelationship with international markets.This study also explores the chances of other common seasonal anomalies discrediting the efficient market hypothesis in the Indian market viz., Other January Effect and Beginning of the month and End of the month effect. This study has used CNX 500, S&P CNX Nifty, CNX Nifty Junior, CNX mid cap and CNX small cap indices of National Stock Exchange of India (NSE). Statistical techniques like dummy variable regression analysis, ARIMA modeling, parametric and non-parametric tests, etc. have been used to fulfill the objective of the study.

The findings of the study exhibit a significantly pronounced April Effect in CNX smallcap and CNX midcap indices, with relatively much lower return in March (although statistically not significant).These findings are consistent with the tax-loss-selling hypothesis.

An interesting finding of the study, which is apparently unique, is the presence of statistically significant and strongly positive December effect in all the studied indices.

Keywords: January Effect, Turn-Of-The-Year Effect, Other January Effect, Seasonality in Stock Returns, Efficient Market Hypothesis, Tax Loss Selling Hypothesis, ARIMA, ARCH

1. Introduction

Capital market efficiency has been an important subject for empirical research. The pioneering work in this regard was done by Eugene Fama (1970) who reviewed the theoretical and empirical literature on the efficient market model also known as Efficient Market Hypothesis. According to this Hypothesis, securities markets are extremely efficient in reflecting information about the stocks. When new information arises, the news spreads quickly and is immediately incorporated into the price of equity. Thus, neither Technical Analysis nor Fundamental Analysis is of any help in selecting undervalued stocks. Subsequently, researches were done to investigate the randomness of stock price movements which suggests that the flow of information is unobstructed and is immediately reflected in stock prices. Consequently, tomorrow's price change will reflect only tomorrow's news and will not be dependent on today's price. Because news is unpredictable, the price change must also be unpredictable and random. However, researchers have demonstrated market inefficiency by identifying orderly variance in stock returns. One such important variation or anomaly is "January effect" or "Turn-Of-The-Year Effect".

Commonly referred to as "January Effect", "Turn-Of-The-Year" effect is the tendency of the stock market to rise between the last day of the last financial month and the end of the first week of the first month of the next financial year. In most of the developed countries financial year starts in January and ends in December which is the reason behind the common nomenclature of this anomaly as the January Effect. Returns are high in small firm stocks which have been pulled-down in the immediate past and these small stocks tend to outperform large stocks during the course of the first month of the year (Wachtel, 1942; Rozeff and Kenny, 1976; Keim, 1983; Banch and Chang, 1990). This is the reason why this effect is predominantly noticeable in stock indices having higher proportion of small firm listings.

"Other January Effect" is the assumption that the trend set in the first month of the year often indicates the future performance of the market in the following 11 months. A 'positive January returns' means the market is on the road for a gainful year, and a 'negative January returns' indicate weakness in the market through the following December (Cooper et.al.,2006).

While the empirical studies prove the existence of January effect in different markets (Keim, 1983; Roll 1983), there is likelihood of existence of the same in Indian stock markets. It has been shown that January effect exists in US and other developed countries (Officer, 1975; Rozeff and Kinney, 1976; Gultekin and Gultekin, 1983). Since December is a tax month, Investors tend to sell the loss-making shares towards the end of the year to reduce their tax liability (Branch, 1977). This behaviour of investors exerts downward pressure on stock prices. In January, they start buying the shares again. This exerts upward pressure on stock prices and it results in higher returns in month of January (Branch, 1977). The Indian tax system is different from the USA and other developed and developing countries. The tax year ends in March in India as compare to December in the USA. The taxpayers have to bear the capital gain tax on the sale of shares. The capital losses can be adjusted against the capital gains. Therefore, if this type of anomaly is present in India's stock market, it should have an impact on the returns in March and April months. In case of some other reason for this anomaly it should be present in the month of January in Indian market because of its interrelation with international markets. A comparison of the historical share price data makes us believe that the share price behaviour of the Indian stock markets has a high positive correlation with the stock markets of developed countries. Mukherjee and Bose (2008) state that there is distinct information leadership from the U. S. market to all Asian markets and the U.S. market not only influences Asian markets but also in turn get influenced by them. They further state that Indian stock returns are guided by major stock index returns in the United States, Japan, and other Asian markets. Indian Markets have also considerable influence on other Asian Markets.

2. Previous Research: Studies on Market Anomalies in the Indian Context

Limited numbers of studies have been carried out on market anomalies in the Indian markets. Sarma (2004) showed the presence of the highest variance on Mondays. Pandey (2002) reported that the returns are statistically significant in the month of March, July and October and significant negative return in March is in line with tax-loss-selling hypothesis. Rengasamy and Al-Macki (2008) reported lower returns on Mondays and Fridays and highest return on Wednesdays in select indices of the National Stock Exchange. Bodla and Kiran (2006), studied anomalies in Indian stock markets and found the turn of the month effect as well as the semi-monthly effect in the Indian market. Mahendra and Kumari (2006) did not find Monday effect or January effect in Indian stock market. However, they did find April returns to be higher than that of nine of the remaining months in Indian stock Market. Patel (2008) found a November-December Effect with significantly positive mean returns for November and December and a March-to-May effect, with significantly negative mean returns for the period. Garg et al.(2010) examined five types of anomalies (the turn of the month effect, the semi-monthly effect, the monthly effect, the Monday effect and the Friday Effect) in Indian and US stock markets taking the Indian market as example of the emerging market and the US market as the representative of the developed market. According to this study, the Monday effect is present only in India, but turn of the month effect and the semi-monthly effect are exhibited in both countries. They concluded that seasonal anomalies are still present despite increased use of information technology and regulatory developments. However, a recent study (Nandini et.al, 2012) did not find any trace of the presence of turn-of-the-year effect in Indian market; it rather found December to have significantly high return, in fact the highest among all months. Nageswari and Selvam (2011) did not find the Day of the Week Effect and the Monthly Effect in the Indian Stock Market.

The above literature provides, to an extent, conflicting views about stock returns in the Indian stock Market. Despite the fact that the January effect is a much studied and researched topic worldwide, it is still in nascent stage in India and this motivated us to take up this study. The focus of the study is to locate the existence of the seasonality, in particular the January Effect or the Turn-of-the-Year Effect, in Indian Stock Market.

3. Data Description

Seasonality as well as the monthly effect is more easily detected in market indices or large stock portfolios than in individual share prices (Officer, 1975). We have obtained monthly and daily data of CNX 500, S&P CNX Nifty, CNX Nifty Junior, CNX midcap and CNX small cap indices from the official site of the National Stock Exchange, www.nseindia.com. Returns are calculated as continuously compounded monthly percentage change in the index prices.

Table 1: Period of Study

Sl. no.	Index	Period
1	CNX SMALL CAP	02.01.2004 to 29.06.2012
2	CNX MID CAP	01.01.2001 to 29.06.2012
3	S&P CNX 500	07.06.1999 to 29.06.2012
4	S&P CNX NIFTY	03.01.1994 to 29.06.2012
5	CNX NIFTY JUNIOR	04.10,1995 to 29.06.2012

4. Methodology Employed

This section will provide detailed discussion on the various approaches adopted by us in studying behavioral aspects of the return series data.

4.1. Calculation of Return

We have calculated stock return as the continuously compounded percentage change in the monthly closing share price indices using the following formula:

Figure 1: Return formula

$$r_t = Ln(P_t / P_{t-1}) \text{ X } 100,$$

Where r_t is the return for the month t, P_t is the monthly closing share price of the index for the month t, and Ln is the natural logarithm function.

4.2. Preliminary Study of Monthly Return Pattern

Before proceeding to regression analysis, we try to extract some firsthand information for the monthly return pattern using descriptive statistics and some very informative graphs comparing the return patterns, month wise and index wise. These preliminary studies help us in understanding general trends which form the basis our hypotheses.

If the preliminary results suggest the difference in the mean returns of two or more months, we use statistical tests to test the significance of the difference in mean returns. Some previous studies have used ANOVA technique for testing the overall difference in means followed by post-hoc tests for pairwise comparison of means (Garg et al., 2010). In some other studies, Non-Parametric tests like Kruskal-Wallis test, Mann-Witney U test, and Friedman ANOVA have been used to test the difference in the mean returns of different months. To decide over the selection of tests (Parametric or Non-Parametric), normality of the data is tested using the Shapiro Wilk test and Q-Q plots. If the data does not confirm to normality, non-parametric tests will be preferred over the parametric tests. From the results of the Shapiro-Wilk test, it was found that data for some of the months were normal, while for some months, data significantly deviated from normality. These results were reiterated by the Q-Q plots

4.3. Dummy Variable Regression Model

In order to further investigate the presence of turn-of-the-year effect, the following dummy variable regression model has been used:

Figure 2: Dummy variable regression model

$$r_t = \alpha_1 + \alpha_2 D_{Feb} + \alpha_3 D_{Mar} + \alpha_4 D_{Apr} + \alpha_5 D_{May} + \alpha_6 D_{Jun} + \alpha_7 D_{Jul} + \alpha_8 D_{Aug} + \alpha_9 D_{Sep} + \alpha_{10} + \alpha_{11} D_{Nov} + \alpha_{12} D_{Dec} + \varepsilon_t$$

here, α_1 indicates the mean return for the month of January and the coefficients α_2, α_3,………,α_{12} represent the average differences in return between January and each month *i.e.* the deviation of return for every month from the return for January. January has been taken as the benchmark month in this model. D_{Feb}, D_{Mar},………, D_{Dec} are the dummy variables for the respective months and are defined as follows:

D_t = 1, if the return is for the month t

0, otherwise

If the mean return for any month is not different from the mean return for January, the value of its coefficient should be zero or we can say that if coefficient for any month comes out to be significantly different from zero, it shows a significant difference in the mean return of that month and the mean return of January. Thus the null hypotheses can be constructed as follows:

Figure 3: Null hypothesis

H_0: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = \alpha_{10} = \alpha_{11} = \alpha_{12} = 0$

I.e. mean return of all the months are equal.

This hypothesis is tested against the alternative that mean return of at least one of the months is different from others. The p-value of the F-statistic decides whether we should accept the null hypothesis or not.

The significance of individual coefficients is tested using t-test for the following null hypothesis,

H_{0i}: $\alpha_i = 0$; *i.e.* mean return for the i[th] month is not significantly different from the mean return of January.

Rejection of any of the above mentioned null hypotheses will imply the presence of monthly effect (seasonality) in the respective month.

The problem which we may face with this approach is the presence of serial correlation among the residuals. This problem can be taken care of by introducing ARIMA model for the residual series in the dummy variable regression model.

Presence of serial correlation in the squares of returns resulting in distinct periods of high volatility and relative stability, i.e., volatility clustering, which is also called the ARCH effect, in the return series can also lead to unsatisfactory regression results. Some authors (Nandini et al., 2012) have used GARCH models to account for the presence of the ARCH effect in the return series. In our study, we will test for the presence of ARCH effect using the Engle test (Brooks, 2011).

We will use the GARCH model or any variant of this model only when we have evidence confirming the presence of the ARCH effect.

4.4. Testing for the Presence of the Beginning-of-the-Month Anomaly and End-of-the-Month Anomaly in the First Financial Month and Last Financial Month Respectively

Trading days during the beginning of the first financial month are considered to be high yielding days and during the end of the last financial month are considered to be low yielding days. In our study we want to test for the presence of this anomaly in the return series of CNX Small Cap index as this phenomenon is expected to be more prominent in the return series of small firms. The mean return of the first five trading days of the first financial month (April) is taken as the mean return of the beginning-of-the-month of April and mean return of the last five trading days of the last financial month (March) is taken as the mean return of the end-of-the-month of March. The same procedure has been followed for January (the first calendar month) and December (the last calendar month). The column graphs are used to compare the mean return for the beginning (or the end) of the month with the mean return of the rest of the trading days of the month. Paired t-test can be used to test the significance of difference between means (Boudreaux, 1995). We will also use the non-parametric equivalent of paired t-test, the Wilcoxon signed rank test, for this purpose.

4.5. Test for the Presence of other January Effect

Cooper et al. (2006) coined the term other January effect (OJE) to reflect on the observation that the 11-month returns from February to December conditional on positive January returns are significantly higher than those conditional on negative January returns. The OJE is one of the important seasonality factors and has been time and again studied by researchers (Bohl and Salm, 2010). We have used the following dummy variable regression model to test for the presence of OJE:

Figure 4: Dummy variable regression

$$r_t = \alpha + \beta J_t + \varepsilon_t$$

where r_t is the 11-month return from February to December in the year t for the respective index, J_t is a dummy variable such that, $J_t = 1$; if the mean Jan return is positive and $J_t = 0$, otherwise.

We test the following null hypothesis,

Ho: $\beta = 0$; a significantly positive value of β proves to be an evidence in support of the OJE.

β gives us the spread in returns between the 11-month mean returns following the positive January returns and the 11-month mean returns following the negative January returns.

We have also calculated correlations between the January returns and the corresponding 11-month mean returns. The significance of these correlations is tested using the t-test for the significance of sample correlation. The test statistic is given as,

Figure 5: t-statistic

$$t = r * \sqrt{\frac{n-2}{1-r^2}}$$

where r is the calculated sample correlation, and n is the sample size. This statistic follows t distribution, under the null hypothesis, with n-2 degrees of freedom.

The presence of significant correlation will provide additional evidence in support of the OJE.

In our study, we have also tried to trace the possible presence of OJE type effect in the month of April, as in India April is the first month of financial year.

4.6. Software used for Analyses

SPSS (Statistical Package for the Social Sciences), EVIEWS, and MS Excel have been used for analyses, testing, and modeling during the course of our study.

5. Results and Discussion

5.1. Preliminary Study

Table 2: Mean and Standard Deviation of Monthly Returns

Month	Index									
	CNX SMALL CAP		CNX MID CAP		CNX NIFTY 500		S&P CNX NIFTY		CNX NIFTY JUNIOR	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Jan	-2.28828	12.61414	-3.01071	10.14381	-0.85424	8.856428	-1.36586	8.287384	-0.91968	8.939746
Feb	-1.58739	5.131898	-0.31018	5.394026	0.741475	5.484465	2.089508	5.64112	0.995441	6.936395
Mar	1.055003	8.803346	-1.47344	10.5988	-2.07605	9.627195	-0.99839	7.883876	-0.97817	11.78539
Apr	7.357989	4.58752	5.068778	5.740876	0.917074	8.587368	0.925925	7.036299	2.827613	11.60666
May	1.362211	15.74261	1.624081	14.72324	-0.38699	13.19591	-0.01008	10.13795	0.331589	14.06289
Jun	-1.7074	8.202415	-1.22732	9.678422	0.628399	8.418907	1.36762	7.586352	-0.95107	10.50679
Jul	4.632905	4.469601	2.299119	7.446935	1.948017	6.956341	1.176415	5.92241	3.281574	8.155582
Aug	4.779894	8.135157	2.986212	6.179461	3.384887	6.280143	0.892913	6.301921	1.740567	6.183128
Sep	1.540151	9.589357	1.480892	8.890581	0.45051	9.083637	0.728183	7.976781	0.356945	10.16897
Oct	-4.83224	18.24278	-1.43318	11.70615	-1.69481	11.31528	-2.14305	9.99301	-2.41784	10.32231
Nov	-0.0422	11.34897	4.794964	7.826788	4.089086	6.849813	0.923605	7.582434	1.86015	9.740818
Dec	5.715635	8.391356	5.753769	8.186828	5.495868	6.507945	4.2441	4.890167	6.740601	8.763869

From the table 2 we can see that the mean returns of January and October are coming out to be negative for all the five indices. Also, mean monthly returns of April, July, August, September, and December are positive for all the five indices. Apart from this, we can also verify that the mean monthly returns of April and December, in particular, are very high as compared to the mean returns of other months. Consistency in the return pattern of certain months, in all indices, hints in favour of the presence of seasonality. Column graphs (figure 6-10), showing index wise mean monthly returns, reveal that mean returns in the months of April and December are very high for the CNX small cap and CNX mid cap indices, while the mean returns of December are highest for all the indices.

5.2. Index Wise Mean Monthly Returns

Figure 6: Mean Monthly returns for CNX small cap

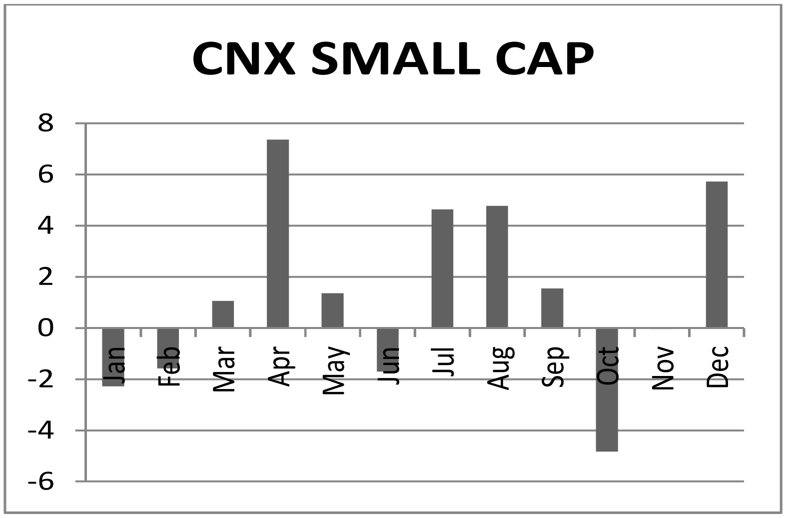


Figure 7: Mean monthly return for CNX mid cap

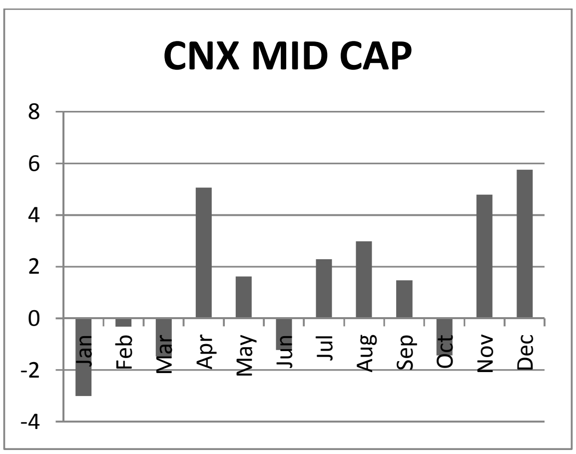


Figure 8: Mean monthly return for S&P CNX500

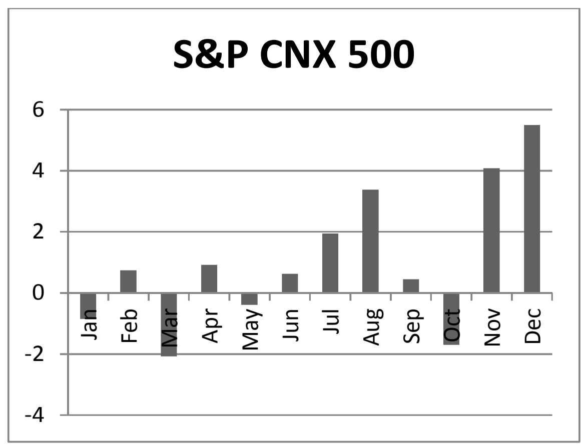


Figure 9: Mean monthly return for S&P CNX nifty

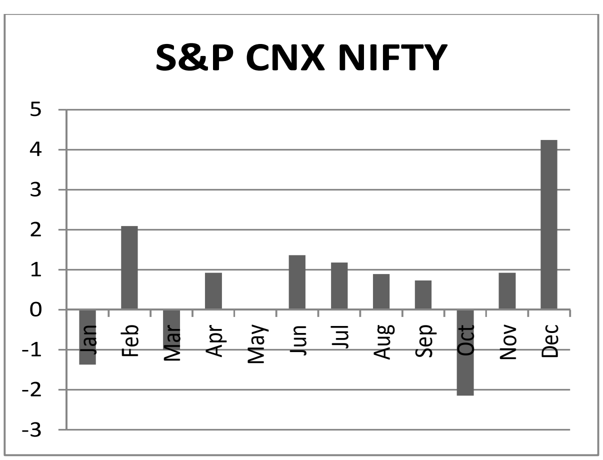


Figure 10: Mean monthly return for CNX nifty junior

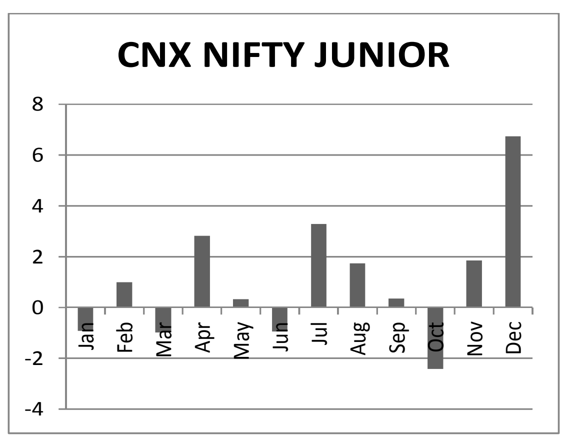
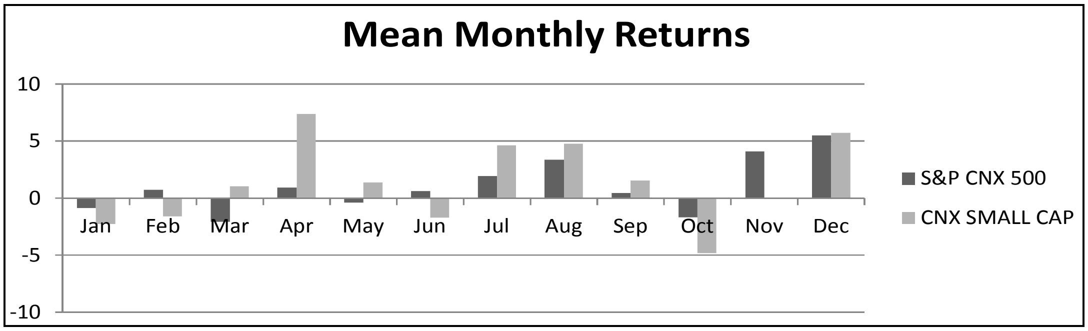


Figure 11: Comparison of mean monthly returns of S&P CNX 500 with that of CNX small cap



From the figure 11 we can observe that the major differences in the mean monthly returns for CNX small cap and S&P CNX 500 exist for the months of April, July, October, November, and December. In particular, the mean return of April is much higher for CNX small cap as compared to that for S&P CNX 500. However, the mean return of November is much higher for S&P CNX 500 than that for CNX small cap. Tall red buildings on the negative and positive sides of the x-axis suggest that the difference among the mean returns of different months may be more pronounced in the CNX small cap index.

Figure 12: Comparison of mean returns of April for S&P CNX 500 with that of CNX small cap

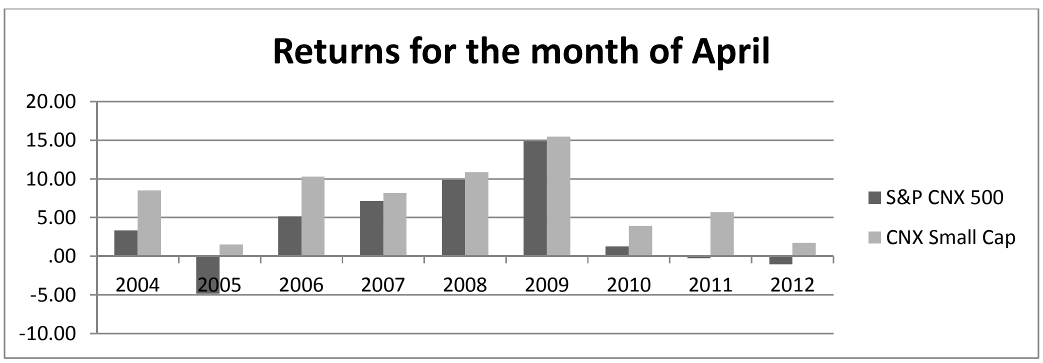
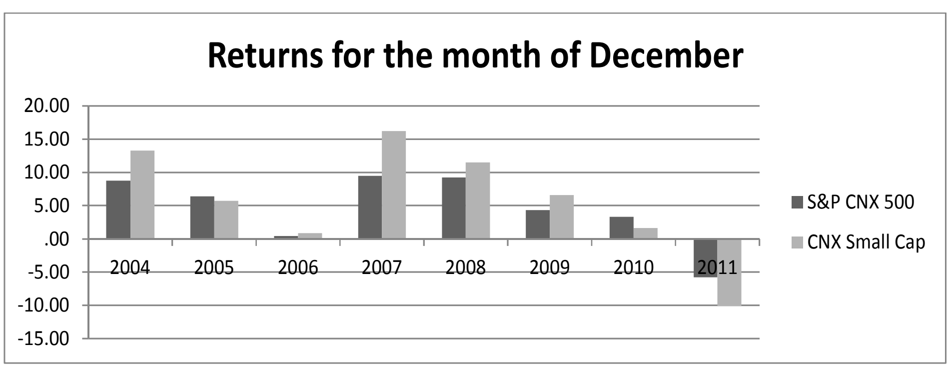


Figure 13: Comparison of mean returns of December for S&P CNX 500 with that of CNX small cap



From figure 12 we can verify that the returns in April are generally positive and high for all the years (with few exceptions) and, at least for CNX small cap, returns are never negative in the span of 9 years. After the year 2009, return in April has decreased substantially, but we cannot conclude anything about the declining trend as this may be a temporary shift due to the market slowdown since 2008. Return for S&P CNX 500 in April has plummeted to very low levels but for the same period CNX small cap has maintained fairly positive returns.

Figure 13 gives a similar picture for the December month. Except for the year 2011, return in December for all the years is positive and most of the times it is fairly high. Highly negative return in December of 2011 for both the indices may be a result of the economic slump in the US and Europe.

Figure 14: Comparison of mean returns of January for S&P CNX 500 with that of CNX small cap

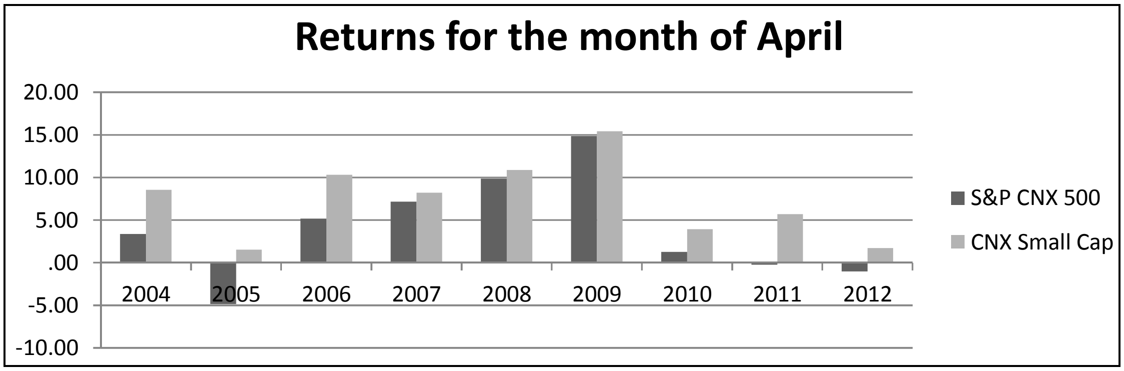


Figure 14 shows that, in each year of our study, the mean return of January has been either very low or negative. The extremely negative return for both the indices in January 2008 may be the result of the knee jerk reaction of investors to the global economic crisis which originated from the US debt crisis.

From the above discussions we can follow that there may be some seasonal factors behind the consistently good performance of April and December in terms of returns.

Preliminary interpretations based on descriptive statistics and graphs give us motivation to move on with the search for the presence of seasonality in the five chosen indices of the Indian market.

Table 3: P-values (prob.) of Kruskal-Wallis test and Friedman ANOVA

Test	CNX SMALL CAP	CNX MID CAP	S&P CNX 500	S&P CNX NIFTY	CNX NIFTY JUNIOR
Kruskal-Wallis	.150	.319	.482	.569	.461
Friedman ANOVA	.131	.04	.463	.572	.233

For the CNX mid cap data, Friedman ANOVA detects that at least one of the mean monthly return is significantly different from the others, however, Kruskal-Wallis test for the same data concludes otherwise. For other indices, results of both the tests show that we do not have enough evidence to reject the null hypotheses of equality of all the mean monthly returns. However, we would like to perform pair-wise tests to test the significance of the difference between the mean return of April and that of other months.

Table 4: P -values (prob.) of results of Wilcoxon Mann-Whitney U Test for testing the significance of difference between mean return of April and other months

Months Compared	CNX SMALL CAP	CNX MID CAP	S&P CNX 500	S&P CNX NIFTY	CNX NIFTY JUNIOR
Apr vs. Jan	.054	.023	.489	.412	.143
Apr vs. Feb	.003	.050	.663	.422	.278
Apr vs. Mar	.102	.204	.457	.550	.326
Apr vs. May	.047	.225	.369	.630	.249
Apr vs. Jun	.007	.073	.778	.493	.278
Apr vs. Jul	.336	.424	.663	.738	.914
Apr vs. Aug	.773	.460	.427	.784	.368
Apr vs. Sep	.149	.389	.939	.952	.564
Apr vs. Oct	.043	.176	.701	.395	.105

Table 4: P -values (prob.) of results of Wilcoxon Mann-Whitney U Test for testing the significance of difference between mean return of April and other months - continued

Apr vs. Nov	.336	.951	.209	.976	.744
Apr vs. Dec	.847	.854	.158	.095	.593

Significant at 1% level of significance
Significant at 5% level of significance
Significant at 10% level of significance

In table 4, the mean of April returns is tested for the significance of difference with the mean monthly returns of the remaining months.

For the CNX small cap index, the mean April return is significantly different (higher in our case) from the mean monthly returns of January, February, May, June, and October. Also, for CNX midcap index, the significant difference is found between the mean return of April and the mean returns of January, February, and June. In case of S&P CNX nifty, only the mean return of December is significantly different from the mean return of April. However, no significant case is found for S&P CNX 500 and CNX nifty junior. This again supports the findings of some previous studies that seasonality in the form of turn-of-the-year effect, if present, is more prominent in small cap indices. This suggests that turn-of-the-year effect may be present in the CNX small cap and CNX mid cap indices.

Table 5: P-values (prob.) of results of Wilcoxon Mann-Whitney Test

MONTHS COMPARED	CNX SMALL CAP	CNX MID CAP	S&P CNX 500	S&P CNX NIFTY	CNX NIFTY JUNIOR
Jan vs. Feb	.923	.460	.817	.236	.570
Jan vs. Mar	.700	.356	.858	.715	.593
Jan vs. Apr	.054	.023	.489	.412	.143
Jan vs. May	.847	.538	.778	.715	.904
Jan vs. Jun	.847	.460	.590	.302	.524
Jan vs. Jul	.208	.140	.427	.393	.235
Jan vs. Aug	.248	.094	.191	.429	.368
Jan vs. Sep	.401	.250	.663	.411	.494
Jan vs. Oct	.916	.279	.858	.950	.971
Jan vs. Nov	.600	.061	.144	.343	.399
Jan vs. Dec	.141	.045	.061	.054	.022

Significant at 1% level of significance
Significant at 5% level of significance
Significant at 10% level of significance

We have also compared the mean returns of January with the mean returns of other months (table 5). This is because we wanted to test for the presence of the conventional January effect which is found to be present in many international markets, especially in the US market. Significant differences in the mean returns are noticed in many cases, mostly when the mean return of January is compared with the mean return of April (CNX small cap, CNX midcap), and the mean return of December (CNX midcap, S&P CNX 500, S&P CNX nifty, CNX nifty junior). However, this cannot be considered as evidence supporting the presence of the conventional January effect, as the mean return of January is actually significantly lower than the mean returns of April and December.

5.2. Dummy Variable Regression Models

If the coefficient of a variable in a regression model comes out to be statistically significant, it implies that the variable is crucial for the model or we can say that the variable contains crucial information for the predictability of the dependent variable, which is the return in our case. So, if the coefficient of the dummy variable for a month comes out to be significant, the month acts as information to predict the return and, by the definition of seasonality, this acts as an evidence in support of the presence of monthly seasonality (in that particular month).

5.2.1. CNX Mid Cap

Table 6: Correlogram: Return

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.162	0.162	3.6701	0.055
.|. |	.|. |	2	-0.026	-0.053	3.7644	0.152
.|. |	.|* |	3	0.065	0.081	4.3713	0.224
.|* |	.|* |	4	0.136	0.114	7.0091	0.135
.|. |	.|. |	5	0.061	0.027	7.5511	0.183
*|. |	*|. |	6	-0.109	-0.122	9.2833	0.158
.|. |	.|. |	7	-0.047	-0.022	9.6054	0.212
.|. |	.|. |	8	0.001	-0.019	9.6055	0.294
.|. |	.|. |	9	-0.052	-0.053	10.015	0.349
*|. |	.|. |	10	-0.104	-0.063	11.641	0.310
*|. |	*|. |	11	-0.149	-0.114	15.015	0.182
.|. |	.|. |	12	-0.033	-0.000	15.182	0.232
.|. |	.|. |	13	-0.021	-0.012	15.248	0.292
*|. |	.|. |	14	-0.098	-0.063	16.743	0.270
.|. |	.|* |	15	0.031	0.089	16.894	0.325
.|. |	.|. |	16	0.005	-0.022	16.897	0.392
.|. |	*|. |	17	-0.064	-0.082	17.557	0.417
.|. |	.|. |	18	-0.042	-0.022	17.836	0.466
.|* |	.|* |	19	0.111	0.110	19.826	0.405
.|. |	.|. |	20	0.063	-0.006	20.474	0.429

Table 6 shows the autocorrelations (AC) and partial-autocorrelations (PAC), for the first 20 lags, of the monthly return series of the CNX midcap index. 'Prob.' is the p-value of the Ljung-Box joint statistic which is used to test the null hypothesis of no autocorrelation. Ljung-Box statistic shows that autocorrelation for the first lag is statistically significant at 10% level of significance. However, AC and PAC for the lags 4 and 6 are also considerably high, so while modeling these lags can also be considered while deciding the order of ARMA model.

The Augmented Dickey-Fuller test has the null hypothesis that the series has a unit root, *i.e.,* the return series is non-stationary. Here, the null hypothesis may be rejected at 1% level of significance and we may conclude that the series is stationary. Now it is safe to move on to the dummy variable regression models.

Table 7: Augmented Dickey-Fuller Test Result

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-9.825909	0.0000
Test critical values:	1% level		-3.478911	
	5% level		-2.882748	
	10% level		-2.578158	

Table 8: Dummy Variable Regression Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	2.700532	3.869614	0.697881	0.4865
MAR	1.537276	3.869614	0.397269	0.6918
APR	8.079493	3.869614	2.087932	0.0388
MAY	4.634796	3.869614	1.197741	0.2333
JUN	1.783395	3.869614	0.460872	0.6457
JUL	5.309834	3.952841	1.343296	0.1816
AUG	5.996927	3.952841	1.517118	0.1318

Table 8: Dummy Variable Regression Modelc - continued

SEP	4.491606	3.952841	1.136298	0.2580
OCT	1.577538	3.952841	0.399090	0.6905
NOV	7.805679	3.952841	1.974701	0.0505
DEC	8.764483	3.952841	2.217262	0.0284
C	-3.010715	2.795081	-1.077148	0.2835
R-squared	0.089281	Mean dependent var		1.355947
Adjusted R-squared	0.009138	S.D. dependent var		9.312882
S.E. of regression	9.270234	Akaike info criterion		7.375010
Sum squared resid	10742.16	Schwarz criterion		7.630774
Log likelihood	-493.1882	Hannan-Quinn criter.		7.478946
F-statistic	1.114020	Durbin-Watson stat		1.607133
Prob(F-statistic)	0.355864			

This regression (table 8) has some significant coefficients; coefficients for April and December are significant at 5% level of significance, while the coefficient of November is significant at 10% level of significance. But the value of Durbin-Watson statistic shows that serial correlation is present in the residuals. Also, the R-squared and adjusted R-squared values are too low. We introduce autoregressive (AR) and Moving Average (MA) terms into the model to improve the model by getting rid of the autocorrelation problem. The correlogram from the table 6 gives some initial ideas about the choice of order of the AR and MA terms. Different orders of AR and MA terms were tried and the models were compared based on Akaike Information Criterion (AIC), Durbin Watson statistic, and adjusted R-squared values. Model with a higher adjusted R-square, a lower AIC value, and the Durbin Watson statistic close to 2 is considered to be a better model.

Table 9: Engle Test for the Presence of ARCH Effect

Heteroskedasticity Test: ARCH			
F-statistic	1.417362	Prob. F(10,110)	0.1819
Obs*R-squared	13.81137	Prob. Chi-Square(10)	0.1818

Table 10: Dummy Variable Regression Model 2: Including AR and MA terms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	2.787569	2.900115	0.961192	0.3385
MAR	4.877415	3.100836	1.572936	0.1185
APR	8.195292	3.132805	2.615960	0.0101
MAY	3.427095	3.140672	1.091198	0.2774
JUN	2.621263	3.240640	0.808872	0.4202
JUL	5.900943	4.301738	1.371758	0.1728
AUG	5.895040	3.300745	1.785973	0.0767
SEP	6.335884	3.211709	1.972746	0.0509
OCT	1.140829	3.207214	0.355707	0.7227
NOV	7.828980	3.186117	2.457217	0.0155
DEC	8.324771	2.978875	2.794603	0.0061
C	-3.471674	2.313664	-1.500509	0.1362
AR(1)	0.174301	0.072620	2.400177	0.0180
AR(6)	0.586290	0.072755	8.058360	0.0000
MA(6)	-0.932957	0.022667	-41.16004	0.0000
R-squared	0.292241	Mean dependent var		1.756816
Adjusted R-squared	0.206822	S.D. dependent var		9.018866
S.E. of regression	8.032250	Akaike info criterion		7.112207
Sum squared resid	7483.977	Schwarz criterion		7.441428
Log likelihood	-450.8496	Hannan-Quinn criter.		7.245984
F-statistic	3.421261	Durbin-Watson stat		1.920692
Prob(F-statistic)	0.000120			

Table 10 shows the results of the dummy variable regression model including AR and MA terms. The Durbin-Watson statistic is very close to 2 implying the absence of serial correlation in the residuals. Adjusted R square has increased considerably as compared to the first model which is a good sign for the model and also the F-statistic is significant at 1% level of significance which shows that the estimated model is, overall, a significant model. We have also applied Engle test (Heteroskedasticity test) to test for the presence of the ARCH effect in the model. The null hypothesis assumes that the ARCH effect is not present in the residual series. The result from the table 9 shows that we do not have enough evidence to reject the null hypothesis and hence, we may conclude that the ARCH effect is not present in the residual series.

The estimated value of the constant refers to the mean return of the benchmark month, *i.e.*, January. The coefficients of dummy variables of April and December are highly significant (even at 1% level of significance) which means that the mean April return is significantly different from the mean January return and is approximately 8.2% higher. Similarly, the mean December return is approximately 8.32% higher than the mean January return. The coefficient of dummy variable for November is significant at 5% and the mean November return is approximately 7.83% higher than the mean January return. Coefficient of dummy variable of September is also statistically significant but at 10% level of significance and it shows that the mean September return is 6.34% higher than that of January.

The mean return of the remaining months for which the coefficients of respective dummy variables is not significant can be considered to be equal to the mean return of January as the difference is statistically not significant. The mean return for January is not significantly different from zero which again implies that the mean returns for remaining months (Feb, Mar, May, Jun, Jul and Oct) are very low.

5.2.2. CNX Small Cap

Table 11: Correlogram Return

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|** |	.|** |	1	0.214	0.214	4.7543	0.029
.|. |	*|. |	2	-0.027	-0.076	4.8324	0.089
.|. |	.|* |	3	0.073	0.100	5.3926	0.145
.|* |	.|* |	4	0.189	0.157	9.2263	0.056
.|. |	.|. |	5	0.059	-0.009	9.6086	0.087
*|. |	*|. |	6	-0.171	-0.182	12.798	0.046
*|. |	.|. |	7	-0.068	-0.013	13.315	0.065
.|* |	.|. |	8	0.095	0.073	14.333	0.073
.|. |	.|. |	9	0.057	0.033	14.701	0.099
*|. |	*|. |	10	-0.110	-0.070	16.094	0.097
*|. |	*|. |	11	-0.167	-0.126	19.319	0.056
.|. |	.|. |	12	-0.032	-0.040	19.438	0.078
.|. |	.|. |	13	0.000	-0.016	19.438	0.110
**|. |	*|. |	14	-0.212	-0.164	24.836	0.036
.|. |	.|* |	15	-0.009	0.165	24.847	0.052
.|. |	*|. |	16	-0.015	-0.075	24.873	0.072
.|. |	*|. |	17	-0.042	-0.067	25.094	0.093
*|. |	*|. |	18	-0.116	-0.079	26.789	0.083
.|* |	.|* |	19	0.090	0.187	27.805	0.087
.|. |	*|. |	20	0.042	-0.072	28.035	0.109

The correlogram in table 11 suggests that a mixed ARMA model can be appropriate for this return series, as the Ljung-Box statistic confirms the presence of autocorrelation.

Table 12: Augmented Dickey-Fuller Test Result

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.977914	0.0000
Test critical values:	1% level	-3.497029	
	5% level	-2.890623	
	10% level	-2.582353	

The null hypothesis of non-stationarity may be rejected at 1% level of significance and we may conclude that the series is stationary.

Table 13: Dummy Variable Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	0.700893	5.047815	0.138851	0.8899
MAR	3.343283	5.047815	0.662323	0.5095
APR	9.646269	5.047815	1.910979	0.0592
MAY	3.650491	5.047815	0.723182	0.4715
JUN	0.580878	5.047815	0.115075	0.9086
JUL	6.921185	5.194159	1.332494	0.1861
AUG	7.068174	5.194159	1.360793	0.1770
SEP	3.828431	5.194159	0.737065	0.4630
OCT	-2.543964	5.194159	-0.489774	0.6255
NOV	2.246076	5.194159	0.432423	0.6665
DEC	8.003915	5.194159	1.540945	0.1269
C	-2.288280	3.672825	-0.623030	0.5349
R-squared	0.114967	Mean dependent var		1.330402
Adjusted R-squared	0.005580	S.D. dependent var		10.41743
S.E. of regression	10.38832	Akaike info criterion		7.630380
Sum squared resid	9604.626	Schwarz criterion		7.941088
Log likelihood	-373.3342	Hannan-Quinn criter.		7.756164
F-statistic	1.051016	Durbin-Watson stat		1.500593
Prob(F-statistic)	0.409808			

This is obviously not a good model as the results are not up to our expectations. The F-statistic is insignificant showing that the overall regression is not a good fit. Also, the coefficient of April is the only significant coefficient. The Durbin Watson statistic implies the strong presence of serial correlation among the residuals and also the adjusted R square is very low. This calls for a better model which probably should contain AR and MA terms as suggested by the correlogram in table11.

Table 14: Dummy Variable Regression Model including AR and MA terms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	2.737938	4.459562	0.613948	0.5411
MAR	5.646155	4.737728	1.191743	0.2370
APR	12.21234	4.811605	2.538101	0.0132
MAY	9.145128	4.793839	1.907684	0.0602
JUN	2.526669	4.733993	0.533729	0.5951
JUL	9.721636	3.706226	2.623055	0.0105
AUG	8.114444	4.896517	1.657187	0.1016
SEP	4.279203	4.913265	0.870949	0.3865
OCT	-3.553248	4.933707	-0.720198	0.4736
NOV	0.110275	4.908503	0.022466	0.9821
DEC	9.137851	4.523448	2.020107	0.0469
C	-3.740793	3.578024	-1.045491	0.2991
AR(1)	0.208102	0.116692	1.783343	0.0785
AR(6)	-0.604257	0.097516	-6.196464	0.0000
AR(7)	0.071791	0.119664	0.599936	0.5503

Table 14: Dummy Variable Regression Model including AR and MA terms - continued

MA(1)	-0.007288	0.047470	-0.153536	0.8784
MA(6)	0.912648	0.034293	26.61332	0.0000
R-squared	0.278966	Mean dependent var		1.310923
Adjusted R-squared	0.129141	S.D. dependent var		10.54150
S.E. of regression	9.837309	Akaike info criterion		7.572454
Sum squared resid	7451.494	Schwarz criterion		8.032412
Log likelihood	-338.9053	Hannan-Quinn criter.		7.758243
F-statistic	1.861942	Durbin-Watson stat		1.934479
Prob(F-statistic)	0.037544			

Table 15: Engle Test for the Presence of ARCH Effect

Heteroskedasticity Test: ARCH			
F-statistic	0.112375	Prob. F(5,84)	0.9893
Obs*R-squared	0.598011	Prob. Chi-Square(5)	0.9881

With trial and error technique we reached this model which looked best among other models based on certain criteria like the F-statistic, AIC, Adjusted R square, and Durbin Watson Statistic. The introduction of AR and MA terms of other orders resulted in a decrease in the adjusted R squared value and increase in AIC which motivated us to stick with this model. The Durbin Watson statistic is also fairly good as it is approaching the value 2.

Coefficients of the dummy variables for the months of April, July, and December are significant at 5% level of significance with the respective deviations in their mean return from the mean January return as 12.21%, 9.72%, and 9.14%. Coefficient of the dummy variable for the month of May is significant at 10% and shows 9.15% more average return in May than in January. The Engle test result shows that the ARCH effect is not present in the residuals from the above regression.

5.2.3. S&P CNX 500

Table 16: Correlogram of Return

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.119	0.119	2.2553	0.133
.|. |	.|. |	2	-0.034	-0.049	2.4432	0.295
.|. |	.|. |	3	0.037	0.047	2.6579	0.447
.|* |	.|. |	4	0.077	0.066	3.6140	0.461
.|. |	.|. |	5	0.027	0.013	3.7360	0.588
.|. |	.|. |	6	0.006	0.005	3.7410	0.712
.|. |	.|. |	7	-0.048	-0.054	4.1200	0.766
*|. |	*|. |	8	-0.093	-0.089	5.5508	0.697
.|. |	.|. |	9	-0.030	-0.016	5.6985	0.770
.|. |	.|. |	10	-0.030	-0.031	5.8479	0.828
.|. |	.|. |	11	-0.025	-0.007	5.9537	0.876
.|. |	.|. |	12	0.010	0.029	5.9714	0.918
.|. |	.|. |	13	-0.039	-0.037	6.2381	0.937
*|. |	.|. |	14	-0.079	-0.065	7.3126	0.922
.|. |	.|. |	15	-0.023	-0.016	7.4070	0.945
.|. |	.|. |	16	0.026	0.016	7.5300	0.962
.|. |	.|. |	17	-0.009	-0.012	7.5442	0.975
.|. |	.|. |	18	-0.039	-0.029	7.8137	0.981
.|. |	.|. |	19	0.023	0.034	7.9096	0.988
.|. |	.|. |	20	-0.028	-0.041	8.0516	0.992

Although, Ljung-Box statistic does not show any significant AC or PAC in the return series, for lag one and few higher lags, autocorrelation may be considered to be present as the corresponding AC and PAC values are considerably high.

Table 17: Augmented Dickey-Fuller Test Results

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.01138	0.0000
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

The highly significant value of the ADF test statistic (significant at 1% level of significance) in the table 17 testifies that the monthly return series for S&P CNX 500 index is stationary.

In table 18, we can see that the coefficient of the dummy variable for the month of December is significant at 10% level of significance. None of the remaining coefficients is significant in this model. The negative adjusted R-squared value and the value of the Durbin-Watson statistic force us to search for a better model.

Table 18: Dummy Variable Regression Model to Test Seasonality

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	1.595719	3.411150	0.467795	0.6406
MAR	-1.221802	3.411150	-0.358179	0.7207
APR	1.771319	3.411150	0.519273	0.6044
MAY	0.467250	3.411150	0.136977	0.8912
JUN	1.482643	3.411150	0.434646	0.6645
JUL	2.802261	3.411150	0.821500	0.4127
AUG	4.239131	3.411150	1.242728	0.2160
SEP	1.304754	3.411150	0.382497	0.7027
OCT	-0.840561	3.411150	-0.246416	0.8057
NOV	4.943330	3.411150	1.449168	0.1495
DEC	6.350112	3.411150	1.861575	0.0647
C	-0.854244	2.412047	-0.354157	0.7237
R-squared	0.065693	Mean dependent var		1.053602
Adjusted R-squared	-0.005677	S.D. dependent var		8.672178
S.E. of regression	8.696760	Akaike info criterion		7.237582
Sum squared resid	10891.24	Schwarz criterion		7.472186
Log likelihood	-552.5314	Hannan-Quinn criter.		7.332868
F-statistic	0.920455	Durbin-Watson stat		1.736821
Prob(F-statistic)	0.522605			

Table 19: Dummy Variable Regression Model Including AR Term

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	1.595721	3.196749	0.499170	0.6184
MAR	-1.221799	3.391878	-0.360213	0.7192
APR	1.771321	3.415637	0.518592	0.6049
MAY	0.467253	3.418614	0.136679	0.8915
JUN	1.482646	3.418988	0.433651	0.6652
JUL	2.059997	3.488654	0.590485	0.5558
AUG	4.145753	3.420565	1.212008	0.2275
SEP	1.293009	3.418664	0.378220	0.7058
OCT	-0.842036	3.415638	-0.246524	0.8056
NOV	4.943147	3.391878	1.457348	0.1472
DEC	6.350092	3.196749	1.986422	0.0489
C	-0.854247	2.417628	-0.353341	0.7244
AR(1)	0.125806	0.082999	1.515748	0.1318
R-squared	0.080255	Mean dependent var		0.985701
Adjusted R-squared	0.002530	S.D. dependent var		8.658586
S.E. of regression	8.647626	Akaike info criterion		7.232591
Sum squared resid	10618.96	Schwarz criterion		7.487846

Table 19: Dummy Variable Regression Model Including AR Term - continued

Log likelihood	-547.5258	Hannan-Quinn criter.	7.336269
F-statistic	1.032551	Durbin-Watson stat	1.996054
Prob(F-statistic)	0.422554		

Table 20: Engle Test for the Presence of ARCH Effect

Heteroskedasticity Test: ARCH			
F-statistic	0.269150	Prob. F(5,144)	0.9293
Obs*R-squared	1.388842	Prob. Chi-Square(5)	0.9255

The introduction of AR term of order one in the dummy variable regression model has improved the model which is apparent from the Durbin Watson statistic which is almost equal to 2 and the improved adjusted R-squared value given in the table 18. The Engle test result from table 20 shows lack of evidence in support of the presence of ARCH effect in the residual series of the above regression model.

The coefficient of the dummy variable of December is statistically significant at 5% level of significance. This tells us that mean December return is significantly different from mean January return and is 6.35% higher.

5.2.4. S&P CNX Nifty

Table 21: Correlogram of Return series

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.015	0.015	0.0481	0.826
.|. |	.|. |	2	0.070	0.070	1.1620	0.559
.|. |	.|. |	3	0.004	0.002	1.1651	0.761
.|. |	.|. |	4	0.052	0.047	1.7742	0.777
.|. |	.|. |	5	-0.046	-0.048	2.2598	0.812
.|. |	.|. |	6	0.007	0.002	2.2721	0.893
*|. |	*|. |	7	-0.089	-0.084	4.1075	0.767
*|. |	*|. |	8	-0.090	-0.091	5.9758	0.650
.|. |	.|. |	9	0.040	0.059	6.3439	0.705
.|. |	.|. |	10	0.044	0.054	6.7901	0.745
.|. |	.|. |	11	-0.035	-0.033	7.0785	0.793
.|. |	.|. |	12	0.031	0.027	7.3073	0.837
.|. |	.|. |	13	-0.029	-0.039	7.5054	0.874
*|. |	*|. |	14	-0.099	-0.113	9.8223	0.775
.|. |	.|. |	15	-0.004	-0.006	9.8264	0.831
.|. |	.|. |	16	-0.042	-0.034	10.245	0.854
.|. |	.|. |	17	-0.062	-0.037	11.166	0.848
.|. |	.|. |	18	-0.042	-0.026	11.592	0.868
.|. |	.|. |	19	0.043	0.039	12.041	0.884
.|. |	.|. |	20	0.025	0.037	12.197	0.909

Although, Ljung-Box statistic from table 21 does not show any significant AC or PAC in the return series, for lags seven and eight and few higher lags autocorrelation may be present as the corresponding AC and PAC values are considerably high.

Table 22: Augmented Dickey-Fuller Test Result

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-14.55739	0.0000
Test critical values:	1% level	-3.460035	
	5% level	-2.874495	
	10% level	-2.573751	

The result of ADF test from table 22 indicates that the monthly return series for S&P CNX nifty is stationary.

Table 23: Dummy Variable Regression Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	3.455367	2.499686	1.382321	0.1683
MAR	0.367472	2.499686	0.147007	0.8833
APR	2.291785	2.499686	0.916829	0.3603
MAY	1.355782	2.499686	0.542381	0.5881
JUN	2.733480	2.499686	1.093529	0.2754
JUL	2.542275	2.533240	1.003567	0.3167
AUG	2.258773	2.533240	0.891654	0.3736
SEP	2.094043	2.533240	0.826626	0.4094
OCT	-0.777193	2.533240	-0.306798	0.7593
NOV	2.289465	2.533240	0.903769	0.3672
DEC	5.609960	2.533240	2.214540	0.0279
C	-1.365860	1.791271	-0.762509	0.4466
R-squared	0.044645	Mean dependent var		0.653080
Adjusted R-squared	-0.005636	S.D. dependent var		7.578393
S.E. of regression	7.599720	Akaike info criterion		6.946869
Sum squared resid	12070.95	Schwarz criterion		7.131384
Log likelihood	-755.6290	Hannan-Quinn criter.		7.021373
F-statistic	0.887902	Durbin-Watson stat		1.925732
Prob(F-statistic)	0.553070			

From table 23, we can verify that the coefficient of the dummy variable of December is significant at 5% level of significance and the estimated value of its coefficient shows that mean return in December is 5.6% higher than the mean return in January (-1.37%). However, we try to improve on this model by introducing AR and MA terms.

Table 24: Dummy Variable Regression Model with AR and MA Terms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	2.784639	2.531477	1.100006	0.2727
MAR	0.483236	2.621081	0.184365	0.8539
APR	2.158362	2.617190	0.824687	0.4105
MAY	0.602757	2.621861	0.229897	0.8184
JUN	2.332991	2.629488	0.887242	0.3760
JUL	1.967326	2.554701	0.770081	0.4422
AUG	1.574983	2.648886	0.594583	0.5528
SEP	1.908986	2.618813	0.728951	0.4669
OCT	-1.222000	2.617994	-0.466769	0.6412
NOV	2.263766	2.618381	0.864567	0.3883
DEC	5.240626	2.535318	2.067049	0.0400
C	-0.437999	1.780302	-0.246025	0.8059
AR(7)	0.799647	0.053636	14.90869	0.0000
MA(7)	-0.901674	0.028466	-31.67599	0.0000
MA(8)	-0.068843	0.027055	-2.544559	0.0117

Table 24: Dummy Variable Regression Model with AR and MA Terms - continued

R-squared	0.094336	Mean dependent var	0.629210
Adjusted R-squared	0.030621	S.D. dependent var	7.598320
S.E. of regression	7.481081	Akaike info criterion	6.930147
Sum squared resid	11137.35	Schwarz criterion	7.166080
Log likelihood	-726.5258	Hannan-Quinn criter.	7.025485
F-statistic	1.480597	Durbin-Watson stat	1.964184
Prob(F-statistic)	0.120841		

Table 25: Engle Test for the Presence of ARCH Effect

Heteroskedasticity Test: ARCH			
F-statistic	1.222167	Prob. F(10,193)	0.2789
Obs*R-squared	12.14891	Prob. Chi-Square(10)	0.2752

Regression model in table 24 is clearly an improvement over the model in table 23 when we compare the adjusted R-squared value, the AIC, and the Durbin-Watson Statistic. In this model, also, only the coefficient of dummy variable of December is significant at 5% level of significance, reiterating the result of the previous model. Also, the Engle test results in table 25 shows an absence of ARCH effect in the residual series of the above model.

5.2.5. CNX Nifty Junior

Table 26: Correlogram of Returns

Autocorrelation	**Partial Correlation**		**AC**	**PAC**	**Q-Stat**	**Prob**
.|* |	.|* |	1	0.186	0.186	7.0575	0.008
.|. |	.|. |	2	0.026	-0.010	7.1906	0.027
.|. |	.|. |	3	-0.014	-0.017	7.2288	0.065
.|. |	.|* |	4	0.068	0.076	8.1764	0.085
.|* |	.|. |	5	0.078	0.054	9.4268	0.093
.|. |	.|. |	6	-0.028	-0.057	9.5914	0.143
*|. |	*|. |	7	-0.092	-0.079	11.376	0.123
.|. |	.|. |	8	-0.017	0.015	11.436	0.178
.|. |	.|. |	9	-0.035	-0.045	11.693	0.231
.|. |	.|. |	10	0.008	0.019	11.708	0.305
.|. |	.|. |	11	0.007	0.021	11.717	0.385
.|. |	.|. |	12	-0.000	0.003	11.717	0.469
*|. |	*|. |	13	-0.070	-0.077	12.779	0.465
*|. |	*|. |	14	-0.113	-0.095	15.556	0.341
.|. |	.|. |	15	-0.020	0.016	15.640	0.406
.|. |	.|. |	16	-0.007	-0.016	15.652	0.478
.|. |	.|. |	17	0.020	0.032	15.741	0.542
*|. |	*|. |	18	-0.092	-0.082	17.618	0.481
.|. |	.|. |	19	-0.032	0.010	17.851	0.532
.|. |	.|. |	20	-0.021	-0.033	17.952	0.591

Ljung-Box statistic in table 26 reveals that autocorrelation is present in the monthly return series of CNX nifty junior index.

Table 27: Augmented Dickey-Fuller Test Result

		t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic		-11.70692	0.0000
Test critical values:	1% level	-3.463235	
	5% level	-2.875898	
	10% level	-2.574501	

ADF test result from the table 27 suggests that the monthly return series is stationary.

Table 28: Dummy Variable Regression Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	1.915124	3.432194	0.557988	0.5775
MAR	-0.058483	3.432194	-0.017040	0.9864
APR	3.747296	3.432194	1.091808	0.2763
MAY	1.251272	3.432194	0.364569	0.7158
JUN	-0.031388	3.432194	-0.009145	0.9927
JUL	4.201257	3.485409	1.205384	0.2296
AUG	2.660250	3.485409	0.763253	0.4463
SEP	1.276628	3.485409	0.366278	0.7146
OCT	-1.498155	3.485409	-0.429836	0.6678
NOV	2.779833	3.432194	0.809929	0.4190
DEC	7.660284	3.432194	2.231892	0.0268
C	-0.919683	2.426927	-0.378950	0.7052
R-squared	0.055939	Mean dependent var		1.078950
Adjusted R-squared	0.000701	S.D. dependent var		10.00999
S.E. of regression	10.00648	Akaike info criterion		7.502467
Sum squared resid	18824.36	Schwarz criterion		7.700366
Log likelihood	-738.2467	Hannan-Quinn criter.		7.582554
F-statistic	1.012694	Durbin-Watson stat		1.552832
Prob(F-statistic)	0.436716			

The model presented in table 28 can be improved upon by introducing AR and MA terms, as the value of Durbin-Watson statistic suggests the presence of serial correlation in the residual series. The coefficient of dummy variable of December is significant at 5% level of significance.

Table 29: Dummy Variable Regression Model Including AR and MA Terms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FEB	1.889202	3.037927	0.621872	0.5348
MAR	-0.088680	3.366759	-0.026340	0.9790
APR	3.716394	3.417995	1.087302	0.2783
MAY	1.220253	3.426376	0.356135	0.7221
JUN	-0.062425	3.427752	-0.018212	0.9855
JUL	4.261828	3.479611	1.224800	0.2222
AUG	2.644315	3.480171	0.759824	0.4483
SEP	1.248078	3.479170	0.358729	0.7202
OCT	-1.528785	3.470606	-0.440495	0.6601
NOV	3.893281	3.417442	1.139238	0.2561
DEC	7.817485	3.046046	2.566437	0.0111
C	-0.888642	2.425200	-0.366420	0.7145
AR(1)	0.164900	0.281899	0.584962	0.5593
MA(1)	0.051926	0.288434	0.180026	0.8573
R-squared	0.103225	Mean dependent var		1.166244
Adjusted R-squared	0.040208	S.D. dependent var		9.958623
S.E. of regression	9.756360	Akaike info criterion		7.461470
Sum squared resid	17609.52	Schwarz criterion		7.693160
Log likelihood	-728.4163	Hannan-Quinn criter.		7.555241
F-statistic	1.638055	Durbin-Watson stat		1.994843
Prob(F-statistic)	0.078115			

Table 30: Engle Test for the Presence of ARCH Effect

Heteroskedasticity Test: ARCH			
F-statistic	1.107965	Prob. F(5,188)	0.3576
Obs*R-squared	5.552999	Prob. Chi-Square(5)	0.3522

The model in table 29 is technically an improvement over the previous model, with higher adjusted R-squared value, significant F-statistic, Durbin-Watson statistic almost equal to 2 and lower AIC value. However, in this model also, only the coefficient of dummy variable of December is significant (at 5%) which conveys that the mean return of December is significantly (7.82%) higher than the mean return of January. The mean return of January is -0.89% and the insignificance of the coefficients of all months ,except December, suggests that mean returns for those months are not significantly different from that of January, *i.e.*, mean returns are low for those months.

5.3. Tests for Detecting the Presence of Seasonality during the Closing Days of the Last Financial Month and Opening Days of the First Financial Month in CNX Small Cap Data

5.3.1. Comparison for the Month of April

Figure 15: Percentage contribution of first five trading days to the total return of April

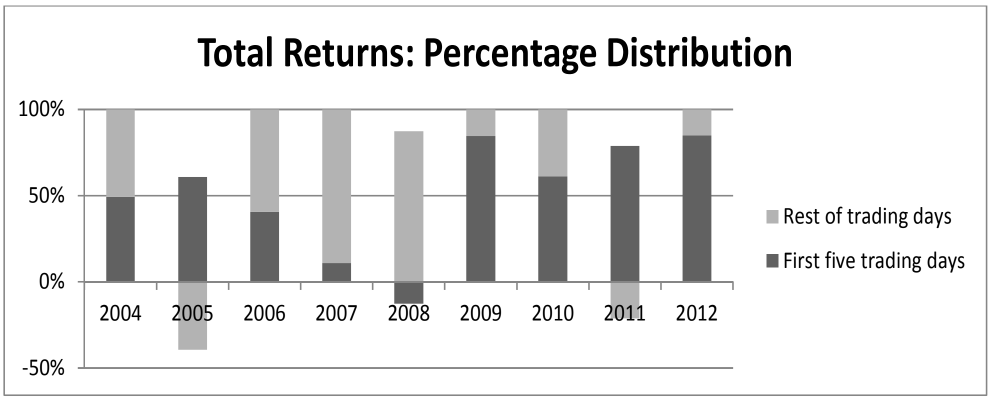
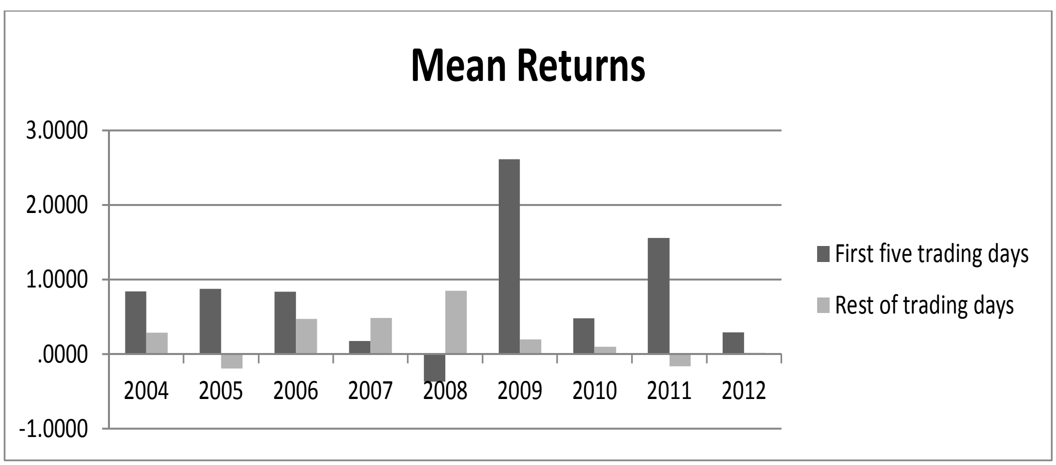


Figure 16: Comparison of mean return of first five trading days with the mean return of rest of the trading days of April



From figure 15, we can see that the first five trading days of April are major contributors towards the total return of the month in at least six out of nine years considered in our study. This anomaly is more noticeable for the data of recent years (2009 onwards). From figure 16 also it can be seen that the mean return of the first five trading days is very high as compared to the mean return of the rest of the trading days for the year 2009 onwards but the difference is not so pronounced till year 2008.

5.3.2. Comparison for the Month of March

Figure 17: Percentage contribution of last five trading days to the total return of March

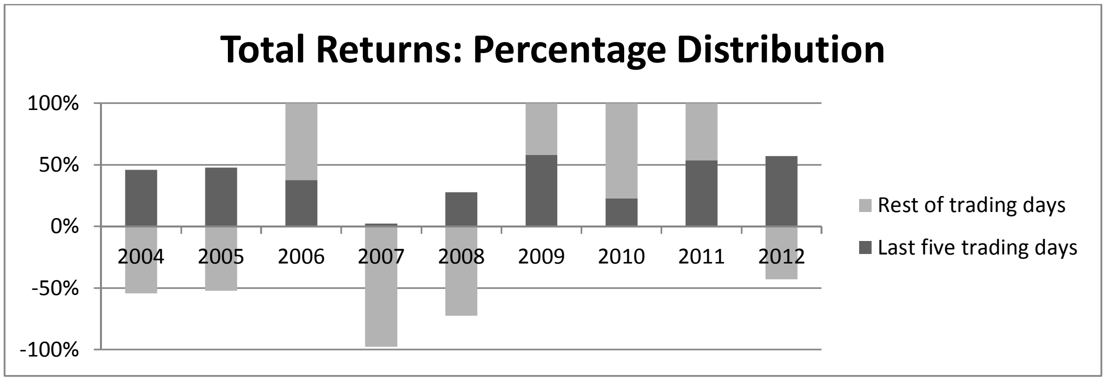


Figure 18: Comparison of mean return of last five trading days with the mean return of rest of the trading days of March

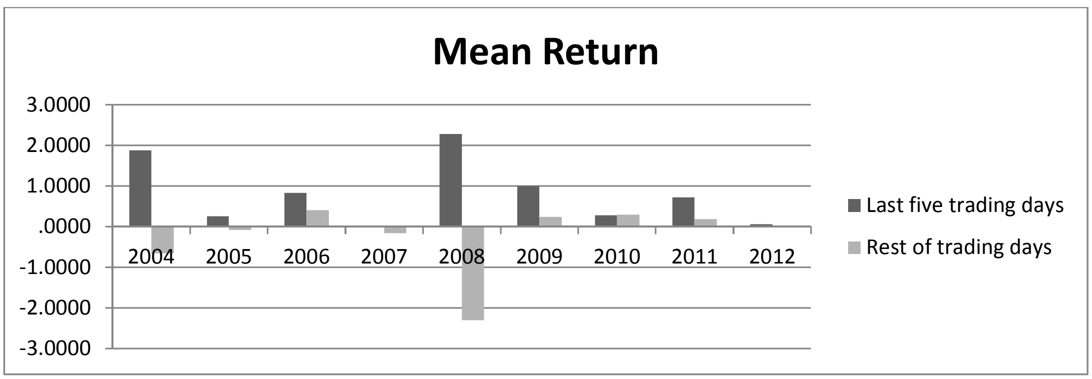


Figure 17 suggests that for most of the years, the last five trading days of March have proved to be good contributors towards the total return of the month (a contrary to the general belief). A Comparison of mean returns in figure 18 also provides us with the information that the mean return of the last five trading days of March is in general positive even if the mean return of rest of the trading days is negative. The presence of tall blue buildings towering over the red ones in figure 18 add weight to our observation.

5.3.3. Comparison for the Month of January

Figure 19: Percentage contribution of first five trading days to the total return of January

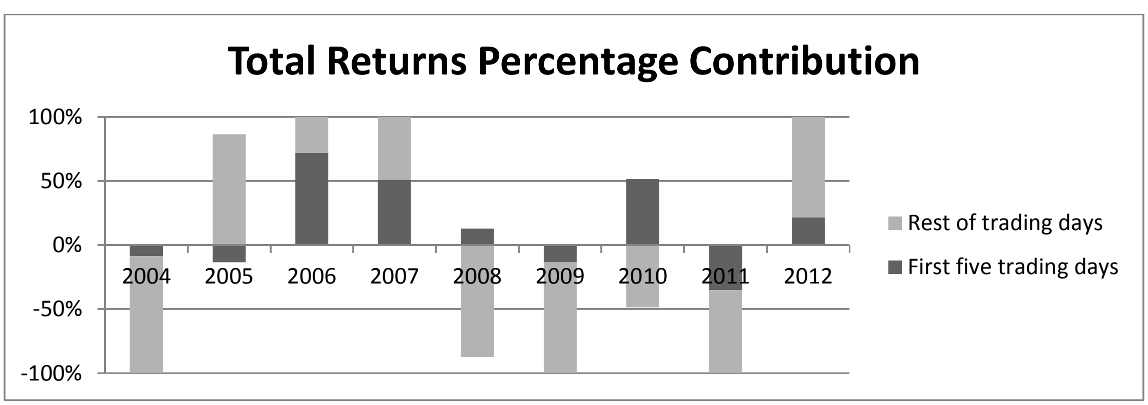
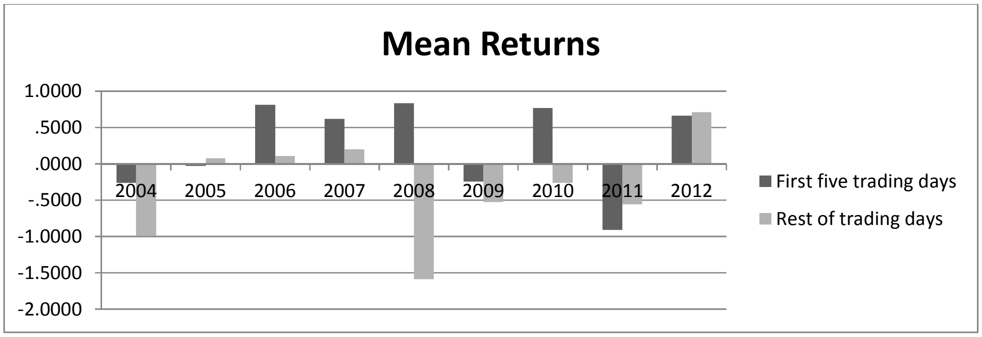


Figure 20: Comparison of mean return of first five trading days with the mean return of rest of the trading days of January



Looking at the figures 19 and 20, it is obvious that, for some years, the total return of the first five trading days of January form a major part of the total return of January, but, for other years, it is hard to extract any such information. Also, the mean return of the first five trading days has been negative for four out of nine years which points against the presence of any seasonality. It is tough to conclude anything from here.

5.3.4. Comparison for the Month of December

Figure 21: Percentage contribution of last five trading days to the total return of December

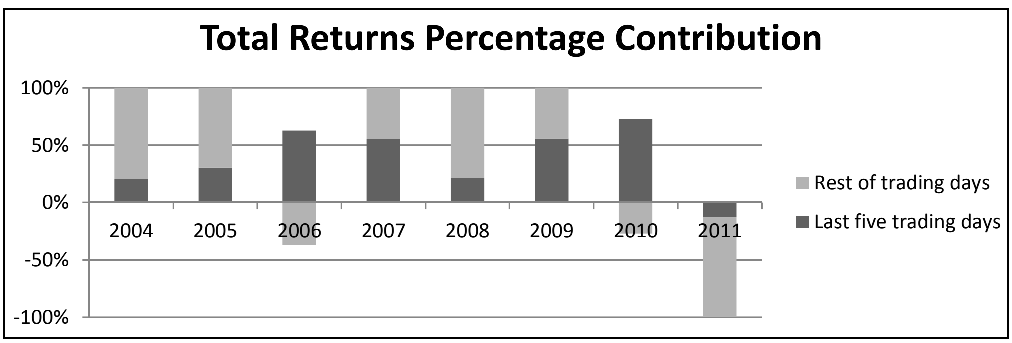
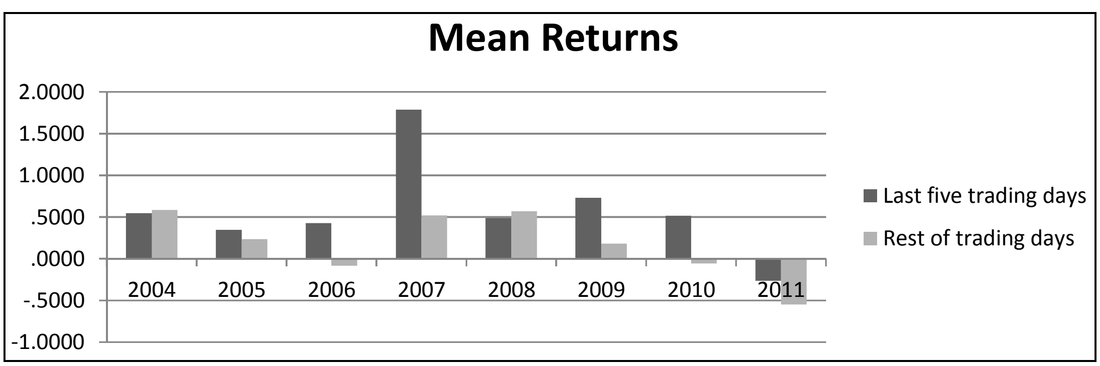


Figure 22: Comparison of mean return of last five trading days with the mean return of rest of the trading days of December



As can be observed from figure 22, for five out of eight years, the mean return of the last five days of December is higher than the mean return of the rest of the trading days. Also, percentage contribution of the last five trading days to the total return of December can be considered to be fairly high for most of the years.

5.3.5. Parametric and Non-Parametric Tests

To throw some more light on the findings from the preceding graphs and to test the significance of those observations, we analyse the results of the following statistical tests.

Table 31: Paired t-test

Month	Mean Return Beginning of Month	Mean Return Remaining of Month	Paired t-statistic	Prob.
April	0.8119	0.2289	1.641	.139
January	0.2493	-0.3148	2.044	.075
March	0.8113	-0.2328	2.046	.075
December	0.5729	0.1751	2.571	.037

Table 32: Wilcoxon Signed Ranks Test

	April	March	January	December
Z	-1.599	-2.547	-1.836	-2.100
Prob.	.110	.011	.066	.036

The results of the paired t-tests and the Wilcoxon signed-rank tests, from the tables 31 and 32, show that the difference between the mean return of the first five trading days and the mean return of rest of the days is significant (at 10%) of January while this difference is insignificant of April. Results for March and December are not consistent with the theory of excessive selling during the end of the last financial (or calendar) month as, on the contrary, the results indicate significantly high returns during the end of March and the end of December as compared to the returns of rest of the trading days.

5.4. Tests for other January Effect and a Similar Effect in April

Table 33: Mean 11-month returns corresponding to positive Januarys and negative Januarys and result of dummy variable regression

Index	Positive January Return		Negative January Return		β (Spread %)	p-value(prob.)
	Return %	N	Return %	N		
CNX SMALL CAP	3.393957036	4	-1.38639759	3	4.78	0.299
CNX MID CAP	2.781647619	3	2.062128274	7	0.72	0.821
S&P CNX 500	0.135002565	5	1.632618219	7	-1.498	0.532
S&P CNX NIFTY	1.004834039	7	0.866547448	10	0.138	0.926
CNX NIFTY JUNIOR	1.751747114	6	1.116006544	10	0.636	0.805

The results presented in table 33 show that spreads are positive for all the indices except for S&P CNX 500, but none of the spread is statistically significant. This may lead to the conclusion that OJE is absent in all the five indices.

Table 34: Mean 11-month returns corresponding to positive Aprils and negative Aprils and result of dummy variable regression

Index	Positive April Return		Negative April Return		β (Spread %)	p-value(prob.)
	Return %	N	Return %	N		
CNX SMALL CAP	0.8813204	8	-	0	(No –ve Return)	
CNX MID CAP	0.8939892	9	3.03344929	2	-2.139	0.514
S&P CNX 500	0.3671258	6	1.19479909	6	-0.828	0.694
S&P CNX NIFTY	0.1419363	9	1.19027328	9	-1.048	0.422
CNX NIFTY JUNIOR	0.7959894	4	1.48362773	1	-0.688	0.782

Table 34 shows that spread of the mean 11-month returns of positive Aprils and negative Aprils are negative for all the indices (except CNX small cap) and none of them is statistically significant. So, we may conclude that OJE type effect is not present in the month of April.

Table 35: Test of significance of correlation between January return and average return of remaining months for different indices

Index	Correlation	t-statistic	Tabulated t @5%	Tabulated t @10%
CNX MID CAP	0.5274741	1.7560883	2.3060041	1.859548
CNX SMALL CAP	0.752485	2.55479	2.570582	2.015048
S&P CNX 500	0.2098658	0.67877	2.228139	1.8124611
S&P CNX NIFTY	0.377526	1.579001	2.13145	1.75305
CNX NIFTY JUNIOR	0.287926	1.124958	2.144787	1.76131

The correlation between January's return and the average return of the remaining months is not significant for any index which can be treated as evidence against the presence of OJE.

Table 36: Test of significance of correlation between April returns and average returns of remaining months

Index	Correlation	t-statistic	Tabulated t @5%	Tabulated t @10%
CNX MID CAP	-0.196842	0.60231	2.2621572	1.8331129
CNX SMALL CAP	-0.04971	0.121915	2.306004	1.859548
S&P CNX 500	0.1654297	0.530443	2.2281388	1.8124611
S&P CNX NIFTY	-0.2563	1.060647	2.119905	1.745884
CNX NIFTY JUNIOR	0.1463791	0.553664	2.144787	1.76131

The correlation between April's return and the average return of the remaining months is not significant for any index which negates the presence of OJE type effect in April.

6. Conclusion

Negative mean returns for March in all indices (except in CNX small cap) and positive returns for the month of April in all indices (statistically significant for CNX small cap and CNX mid cap) are consistent with tax-loss-selling hypothesis. Abnormal return in the month of April is more pronounced in small cap and mid cap stocks which confirms the negative relation between abnormal returns and the size suggested by Keim (1983). The similar pattern of seasonality in CNX small cap and CNX mid cap suggests that mid cap stocks behave like small cap stocks in India and may be an area of further study. Although the mean return in the first five trading days of April is found to be abnormally large in CNX small cap index, it is not statistically significant. So it cannot be said that high yield in April is because of the high return during first five trading days (very early of the month) of April.

Results from the dummy variable regression models confirm the presence of monthly effects in April, August, September, November, and December for CNX mid cap and in April, May, July, and December for CNX small cap. For S&P CNX 500, S&P CNX nifty, and CNX nifty junior, monthly effect is found to be present in December only. Since April is the first month of the financial year in India, it can be concluded that the turn-of-the-year effect is a small cap and mid cap phenomenon in India. Dummy variable for the month of March is not significant for any index which shows that no monthly anomaly is present in March. However, we can observe from the results of dummy variable regressions that even if March is not coming out to be significant, its mean return is always relatively lower than the mean return of April.

It is a very interesting finding that the month of December produces significantly high return for all the indices which we have considered in our study. A critical examination is required to explore the possible reasons behind the strong presence of this December effect. Also, significance of August, September, and November for CNX mid cap needs proper explanation. Significantly positive returns in

November and December may be explained by the Diwali effect (the most auspicious festival for Hindus in India) associated with the increased economic activities especially in the consumer goods section. Another possible reason could be Rabi (winter crop) harvest as suggested by Dash et al. (2011).

Our findings have also established that the Other January Effect is not present in Indian market. This supports the findings of Stivers et al. (2009) that the Other January Effect is primarily a US market-level-based phenomenon. Tests for investigating similar effect for April (April being the first month of financial year in India) confirm that return in April has no significant effect on the average return of the remaining eleven months to follow.

Therefore, the above study finds that the Indian stock market is not efficient and investors may exploit the inefficiency by timing their investment decisions.

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