Presence of Seasonality in Stock Market: A Reference from India and US

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Abstract

Seasonality is periodical and repetitive change in a time series data. It is present in many fields such as production, sales and asset market. Seasonality in return from the stock markets has been the interesting topic for researchers and investors. Although researchers do not agree on the existence of seasonality, supporters of Efficient Market Hypothesis negate seasonality. This research paper analyses Indian and US stock market to validate the existence of any seasonality persistence in any day of the week or any month of the year interval. Data before and after the global crisis of 2008 has been analysed separately to examine if there a change in the pattern of seasonality after the crisis.

Keywords: *Seasonality, Day-of-the-Week Effect, Month-of-the-Year Effect, CNX 500, S&P 500, Stock Market Index*

Introduction

Seasonality is periodical and repetitive change in a time series data which occurs after a continuous period of time. This term came from the stream of geography where seasonality persists due to revolution of earth, tilt of earth relative to its revolution plain and sunlight. Seasonality is studied in production, sales and labor market also. Seasonality in production is a characteristic of a number of branches of industry, including the meat, dairy, fish, food, and lumber industries, construction and agriculture, etc. Seasonal variations in employment are also seen in the industry. For example labors working in sugar industry face unemployment when sugarcane is not available. In case of sales, seasonality can be seen as a function of Demand. For instance sale of vehicles increase during festive seasons where demand is created by offering so many discounts and offers which attracts consumers who are enjoying a period of bonuses and rewards. A higher volume in sales can be seen in the US at the time of Winters similarly it can be seen at the time of Summers in India.

Literature shows that seasonality persists in stock market as well, where a pattern in return on investment has been reported from many stock markets in the world. Seasonal effect due to behavioral causes in the form of January effect, May effect, December effect, Monday effect and Holiday effect are observed. Researchers have also tried finding out many other aspects of seasonality like turn of the month effect, fortnightly effect, quarterly effect, half yearly effect and so on. Some of these effects persist in some markets or the other at some period of time. There are reasons like closing of the year, holidays (christmas, year-end), tax avoidance mechanism which support the existence of

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seasonality in different effects. Payment in the year-end, sentiments during holidays, Aberrations in financial reporting, harvest time and heating season may be attributed for seasonality effect in asset market particularly in stock market.

Also, any kind of existence of seasonality in a stock market means that market does not follow a very strong financial hypothesis known as efficient market hypothesis. Efficient market hypothesis says the prices in the market are comprised of each and every information available to the public; one cannot make abnormal profits due to any information available. But in case of seasonality if there is a pattern that is being followed in the return, one can buy and sell according to the pattern seasonality is following. It can also be observed that if investors are following this pattern seasonality will not last for long. Therefore as the investor becomes more and more knowledgeable the existence of seasonality must fade. Hence a study for older and newer period can depict whether the seasonality is affected by maturates of investors in the stock market.

Just like climatic prediction of meteorology department about rains and monsoon, based on certain tools and historical data, helps farmers and the economy to take its course, seasonality study in stock market too may help investors to accumulate profits on their investment if any persists in the stock market.

Literature Review

Literature on seasonality in stock market dates back to 1919 when Harvard Committee on Research in a comprehensive study of stock prices from January 1897 to January 1914, revealed that there were not any evidence of seasonal tendency. Wachtel(1942) quoted that findings of Richard N. Owens and Charls O. Hardy for the stock prices data up to 1925 presentes a decided lack of seasonality. But Wachtel reported frequent bullish tendencies from December to January for the period of 1927 to 1942 and suggested that seasonal curve must be watched while formulating investment strategy.

Different calendar effects have been reported since then in many studies. Day-of-the-week effect has been reported extensively in various studies (Kelly, 1930; Hirsch, 1968; Cross, 1973; Gibbons and Hess, 1981; Smirlock and Starks, 1986; Jaffe and Westerfield, 1989). Cross(1973) studied the behavior of stock price of New york exchange for the period of 1953 to 1970 and reported the behavior of stock prices on Fridays and Mondays. Stefanescu et al(2009) indicated a significant Thursday effect for Bucharest Stock Exchange and for most of the ten stocks.

Similar researches have been reciprocated for Indian stock market. Anand Sasidharan (2009) reported that stock market returns form indian stock exchange Nifty for the period of 1991 to 2008 did not depict seasonality and attributed one of the calendar effect the-month-of-the-year effect to extreme observations. However Dash *et al* (2011) explored the interplay between the month-of-the-year effect and market crash effects on monthly returns in Indian stock markets and reported positive November, August, and December effects, and a negative March effect.

While these studies were focused on finding seasonality or negating it, Fama (1970) proposed Efficient Market Hypothesis which states that asset prices in financial markets should reflect all available information; as a consequence, prices should always be consistent with 'fundamentals'. Fama et al (1969) defined Efficient Market as a market which 'adjusts rapidly to new information'. Later the definition was modified that asset prices in an efficient market 'fully reflect all available information' (Fama 1991). This implies that the market processes information rationally, in the sense that relevant information is not ignored, and systematic errors are not made. As a consequence, prices are always at levels consistent with 'fundamentals' (Beechey *et al.* 2000). According to this hypothesis, security prices reflect fully all the information that is available in the market. Since all the information is already incorporated in prices, a trader is not able to make any excess returns. This hypothesis was considered one of the most intellectual and advanced contribution to the field of asset market and particularly asset market. However The intellectual dominance of the efficient-market revolution has more been challenged by economists who stress psychological and behavioral elements of stock-price determination and by econometricians who argue that stock returns are, to a considerable extent, predictable(Malkiel 2003). If the market are fully rational then crisis of 2008 could not have spoiled the stock market show much. Malkiel analyses

that many predictable patterns seem to disappear after they are published in the finance literature. As Schwert (2001) points out, there are two possible explanations for such a pattern. One explanation may be that researchers are always sifting through mountains of financial data. Their normal tendency is to focus on results that challenge perceived wisdom, and every now and again, a combination of a certain sample and a certain technique will produce a statistically significant result that seems to challenge the efficient markets hypothesis. Alternatively, perhaps practitioners learn quickly about any true predictable pattern and exploit it to the extent that it becomes no longer profitable.

It is evident from the literature review that extensive study has been done in stock markets individually across the world and comparatively between two countries or among developing and developed nations for different periods of the time. This study compares the stock market returns from American and Indian stock market for a span of 20 years spanning 1995 to 2014. US markets are probably the deepest and most competitive financial markets in the world, so they provide a favourable testing ground for testing seasonality and compare it with Indian stock market. Apart from using data of longer time period for validating the findings of comparative study originality of this comparative study lies in segregation of data in pre and post global stock market crisis. The research paper tries to visualise if there are any pattern of seasonal behaviour in S&P 500 and S&P CNX Nifty and if observed any will test the statistical significance of the same on the empirical data. Here, researcher will also try to observe if there is any impact on seasonality pattern after the period of crisis. By doing this we can also examine whether the seasonality which is persistent in long term exists in recent past as well or not.

Objectives

- To examine the presence of seasonality in S&P 500 and CNX 500.
- To establish the presence of Day-of-the-week effect in S&P 500 and CNX 500.
- To establish the presence of Month-of- the-year effect in S&P 500 and CNX 500.
- To compare the difference in the pattern of seasonality before and after the period of recession in S&P 500 and CNX 500.

Data and Methodology

This study uses historical data of Standard & Poor's 500 (S&P 500) index from United States of America and CNX 500 index for a period of total 14 years. Daily data for S&P 500 index has been taken from Yahoo Finance and data for CNX 500 has been accessed from NSE India. Data has been segregated in two periods: 1st prior to recession, 2001-2007 and 2nd after the crisis period, 2009-2015. Firstly, the returns have been shown in the form of Graphs of "Day of the Week" data and then "Month of the Year" data to depict if any seasonality can be observed. Secondly, the ones which can be observed from the pictorial representation are tested for statistical significance.

To analyse the existence of seasonality we calculate the Returns as Rt=(Ln(Pt)-Ln(Pt-1))*100 where Rt is the return in period t, Pt is the closing prices at time t and Pt-1 is the closing prices at time t-1 for both the indexes and both the time periods. Then to statistically test the significance we execute the t test for the ones visible in the graphs.

To fulfill the objective mentioned above we need to form hypothesis.

Hypothesis for testing the existence of seasonality in the day of the week effect before and after the recession period will be:

$H_{(1,0)a}$: The presence of seasonality in the days of the week effect is not significant prior to the Recession.

$H_{(1,1)a}$: The presence of seasonality in the days of the week effect is significant prior to the Recession.

$H_{(1,0)b}$: The presence of seasonality in the days of the week effect is not significant after the Recession.

$H_{(1,1)b}$: The presence of seasonality in the days of the week effect is significant after the Recession.

Hypothesis for testing the existence of seasonality in month of the year effect before and after the recession period will be:

$H_{(2,0)a}$: The presence of seasonality in the month of the year effect is not significant prior to the Recession.

$H_{(2,1)a}$: The presence of seasonality in the month of the year effect is significant prior to the Recession.

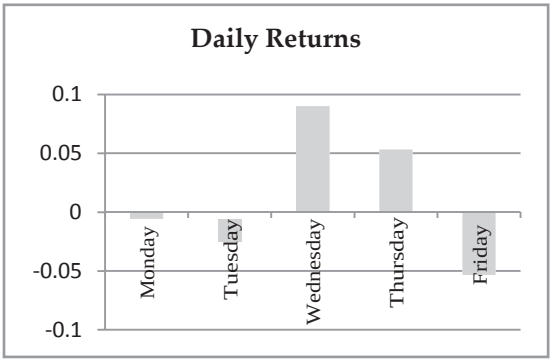
$H_{(2,0)b}$: The presence of seasonality in the month of the year effect is not significant after the Recession.

$H_{(2,1)b}$: The presence of seasonality in the month of the year effect is significant after the Recession.

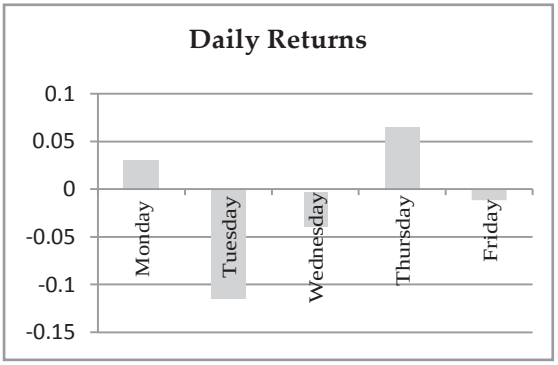
To test the hypothesis derived above we will follow the above methodology and start our analysis in the next part of the research.

Analysis

Firstly, Examination of seasonality has been done for S&P 500 and CNX 500 for the period prior to Recession. Analysis of seasonality is done for S&P 500 first and then checked whether the same persists in CNX 500 or not. As discussed earlier, first graphs have been plotted where the data is divided on the basis of trading days of the week. Figure 1 (a) and (b) shows the average return on S&P 500 and CNX 500 respectively, for the days of the week. A relatively high level of return on Wednesday as compared to any other day for S&P 500 can be observed from the Figure 1(a). But any such effect cannot be seen in the CNX 500. The persistence of Monday effect given in literature cannot be seen in any of the two indices.



(a) S&P 500



(b) CNX 500

Figure 1: Day of the Week Effect prior to the period of Recession

After this, t test is done to test statistically whether the return for Wednesday in S&P 500 is higher than other days of the week or not. Table 1 shows the results of the t test.

Table 1: Results of t test for returns on Wednesday for S&P 500

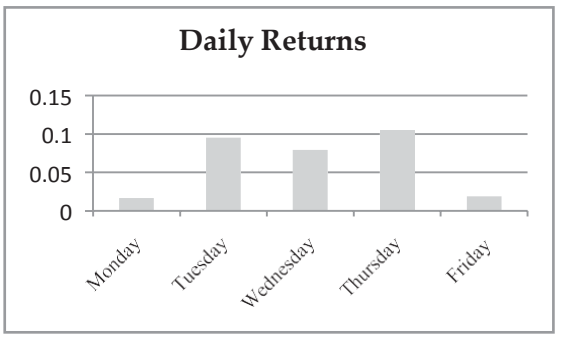
Day	Monday	Tuesday	Wednesday	Thursday	Friday	P-Value
Mean	-0.00575	-0.01972	0.090192	0.053243	-0.05328	0.072
Std Dev	1.125356	1.064843	1.093048	1.020268	0.965036	

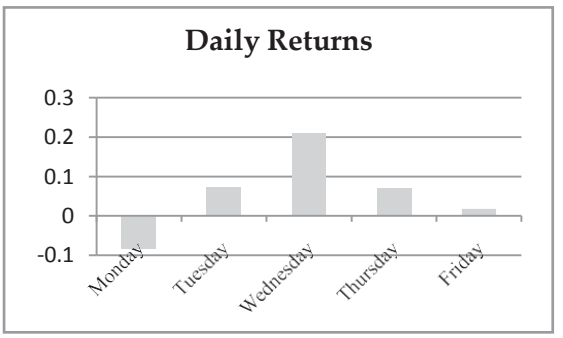
Results in table 1 show that the returns on Wednesday in the data taken for the study are not statistically higher than any other day in the week. For a 95% level of significance the p value of 0.072 says the null hypothesis that there is no significant difference in the returns of the days of the week is accepted. To reject the null hypothesis

that the returns on Wednesday are statistically higher than other days of the week the p-value should have been less than 0.05.

Now Day of the Week Effect after the period of Recession is analyzed for both the indices. No such observation where the returns are higher as compared to the other days of the week can be seen in S&P 500 from the graph.

But a good difference can be observed in CNX 500 on Wednesdays. There is a difference in the pattern of seasonality of both the indices after the recession period. There was no such pattern for CNX before the crisis and no such pattern remained for S&P 500. It can also be observed that both of them show a pattern on Wednesdays only.





(a) S&P 500 **(b) CNX 500**

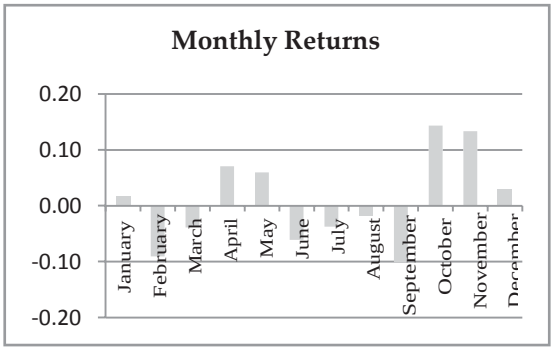
Figure 2: Day of the Week Effect after the period of Recession

Now we move on to test the observation made in the above representation. As mentioned above, if the level of confidence is 95% we need to have a p value of less than 0.05. And it is seen in the table below. Therefore statistical results for higher returns on Wednesday are positive. There is a pattern of higher returns on Wednesday after the period of Recession in CNX 500.

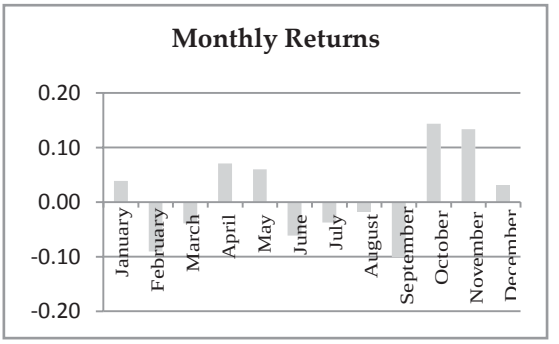
Table 2: Results of t test for returns on Wednesday for CNX 500

Day	Monday	Tuesday	Wednesday	Thursday	Friday	P-Value
Mean	-0.08437	0.07254	0.209372	0.069459	0.017382	0.049675
Std Dev	1.144512	1.134317	1.638312	1.216539	1.161289	

Second phase of our research focuses on finding a pattern of Seasonality in any particular month of the year. For which we first plot the returns for every month. Now from the graphs we can depict a very strong pattern of similar returns for both S&P 500 and CNX 500. Also, A seasonal pattern of higher returns in October and November followed by a negative returns in September for the period prior to Recession.



(a) S&P 500



(b) CNX 500

Figure 3: Month of the Year Effect prior to the period of Recession

Now to test the statistical significance of the seasonality observed above we apply the t test to the monthly returns of the year. It can be seen from the results that higher returns for the month of October for both S&P 500 and CNX 500 are not statistically significant. But the returns for the month of November are higher than any other month of the year in both the indices.

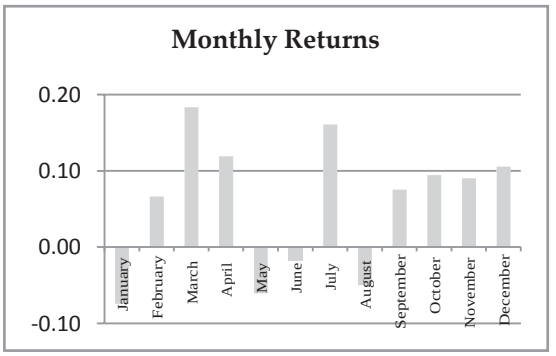
Table 3: Results of t test for returns on October and November for S&P 500 and CNX 500 before the period of Recession

	Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
S&P	Mean	0.02	-0.09	-0.04	0.07	0.06	-0.06	-0.04	-0.02	-0.10	0.14	0.13	0.03
	Stdev	1.07	0.92	1.19	1.12	0.96	0.92	1.33	1.07	1.23	1.21	0.96	0.78
CNX	Mean	0.04	-0.09	-0.04	0.07	0.06	-0.06	-0.04	-0.02	-0.10	0.14	0.13	0.03
	Stdev	1.04	0.92	1.19	1.12	0.96	0.92	1.34	1.07	1.23	1.21	0.96	0.78

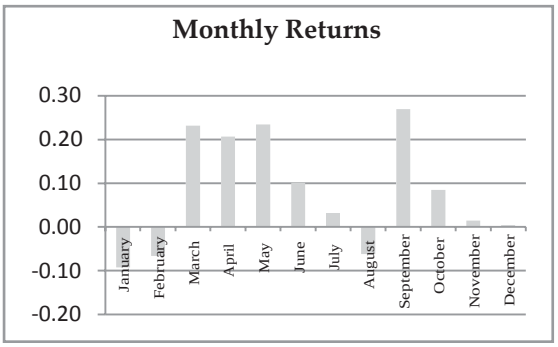
P value	October	November
S&P	0.071	0.044
CNX	0.079	0.052

Here it can also be said that both the indices are so correlated or dependent on each other that they show almost same pattern in the return for every month.

The pattern for monthly returns changed after the period of recession, no similar result can be seen in the following graphs, different pattern of higher returns can be observed although. S&P 500 shows higher returns in the month of March and July. Also, for CNX 500, a pattern of higher returns is observed in the month of March, April, May and September.



(a) S&P 500



(b) CNX 500

Figure 4: Month of the Year Effect after the period of Recession

Results of the Statistical Test tell us that pattern for the S&P 500 is not statistically significant. But Statistical significance is present in the higher returns in the months of March, April and September for CNX 500. The reason for the same should be settlement of taxes around this time.

Table 4: Results of t test for returns on October and November for S&P 500 and CNX 500 after the period of Recession

	Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
S&P	Mean	-0.07	0.07	0.18	0.12	-0.06	-0.02	0.16	-0.05	0.08	0.09	0.09	0.11
	Stdev	1.18	1.19	1.44	1.09	1.23	1.19	0.96	1.47	1.06	1.17	1.08	0.81
CNX	Mean	-0.09	-0.07	0.23	0.21	0.23	0.10	0.03	-0.06	0.27	0.09	0.01	0.00
	Stdev	1.41	1.20	1.28	1.16	1.99	1.28	1.20	1.23	1.12	1.01	1.12	0.97

P value	March		July	
S&P 500	0.136486		0.089803	
CNX 500	March	April	May	September
	0.000	0.038	0.109	0.008

Conclusion

It may be concluded from the above analysis that there are evidences for the presence of seasonality in case of India in CNX 500 especially for the period of 7 years after Recession. Statistically significant abnormal returns are observed on Wednesday when compared to any other day of the week. The persistence of Wednesday effect is also present in literature, which means the results of the paper are in direction of literatures only. Also, a prominent March and April Effect has been observed for CNX 500 due to the Season of Tax settlements around the year. A two digit rate of return is seen in both the prominent effects is seen. In case of S&P 500 no such evidence could be seen for the prominence of seasonality in day of the week or month of the year effect after the period of Recession. When compared with CNX 500 returns in S&P 500 are relatively low. Therefore from this analysis, it can also be said that US markets are more efficient as compared to Indian markets as there are no abnormal returns due to any reason prominent in the market. Also, looking at this picture it can be said that "one follows the other" phenomena which is present in the literature is present in the month of the year effect of S&P 500 and CNX 500 for US and Indian markets. In other words, there is common month of the year effect shared by the two nations. There is dominant pattern of common seasonality.

Also, as it can be seen that no prominent seasonality is present for US Markets and once the markets are Efficient, it can be validated by the research that the postulation by Burton G. Malkiel that such apparent patterns were never sufficiently large or stable to guarantee consistently superior investment results and certainly such patterns will never be useful for investors after they have received considerable publicity stand true.

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