A Study on Days-of-Week and Months-of-Year Anomalies in Key Stock Markets of India

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ABSTRACT

Purpose: *The present study is an attempt to identify the "presence of calendar anomalies" in the Annualized log returns of key stock Market of India.*

Methodology: *Firstly, to avoid spurious regression, the assumptions of stationarity have been checked using descriptive statistics and "Augmented Dickey-Fuller" (ADF) test respectively. Secondly, Wald test has been used to test the significant difference in the annualized log returns on any days of the week and any months of the year in BSE Sensex and Nifty 50 indices.*

Findings: *The Annualized log returns series of BSE Sensex and Nifty 50 are found to be stationary i.e. they were found suitable for the regression model. The result indicates that there is no significant difference in the annualized returns of different weekdays in both Nifty 50 and BSE Sensex indices i.e. there were no significantly different returns on any days of the week. Similar results have been obtained for monthly annualized log returns. Therefore, as per the study, there are days of the week and months of the year anomalies in the key Stock Markets of India.*

Research Limitations: *The calendar effect has been tested by using only two key Indian indices namely National Stock Exchange and Bombay Stock Exchange. By considering other exchanges, it may provide different results. Further, the time span of the study is 5 years. The results would have been different with a longer span of time or different duration of time period.*

Key Words: *Stock markets, anomalies, calendar effects*

INTRODUCTION

"Stock market is an organized market/place for trading financial instruments known as securities which include stocks, bonds, options and futures. A market where the information is "fully reflected" in prices is efficient" (FAMA, 1970). The stock market is efficient or not is under the debate which is unending and still continuing in the branch of Financial Economics (Lahiri, 2012). "An efficient capital market is known as the market in which the prices of share adjust quickly to the availability of new information and therefore, the current price of the shares reflects all available information about the security. The informationally efficient markets require some minimum amount of trading and that more and more trading should cause a quicker price adjustment, making the markets more efficient" (Reilly and Brown, 2012). The overall Efficient Market Hypothesis (EMH) and the empirical tests of the hypothesis is divided by FAMA into three sub-hypothesis, namely: (1) Weak-form EMH, (2) Semi Strong-form EMH (3) Strong-form EMH.

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Weak-form of the EMH suggests that past price movements do not follow any pattern or trend. There are no serial dependencies in past prices. Hence, the information, not present in the price series, determines entirely the future price movements (Nadig, 2014). Technical analysis is used to "identify the presence of weak-form of EMH" (Reilly and Brown, 2012). The semi-strong form EMH assumes that "the current stock prices adjust rapidly to the public information". The semi strong-form of EMH encompasses the weak-form hypothesis, as historical information of market, such as past stock prices and trading volume, is public. FAMA (1991) coined a new term for the semi-strong model—the event study. He uses event studies instead of semi strong-form to test "adjustment of prices to public announcements" (Nadig, 2014). The strong-form of EMH assumes that all the information from both public and private sources is fully reflected in the stock prices.

1.1 Stock Market Anomalies

One of the disturbances of the EMH denotes stock market anomalies. It refers to a situation where securities perform in contrary to the efficient market hypothesis. George & Elton (2001) have explained it as an irregularity from the normal order. (Raj & Kumari, 2006) claimed the strong impact of anomalies for stock market efficiency and trading approaches in the market. Anomalies can broadly be classified as calendar anomalies, fundamental anomalies and technical anomalies (Nawaz and Mirza, 2012). Calendar anomalies are with respect to a specific time period i.e. movement and changes in stock prices from one day to other days, one month to other months and year to year etc. (Karz 2011). Fundamental anomalies relate to anomalies in the valuation of stock prices i.e. identifying the stocks that outperform the others. Fundamental anomalies comprise of "value anomalies and small-cap effect, Low Price to Book, high dividend yield, Low Price to Sales (P/S), Low Price to Earnings (P/E)" (Karz 2011). Technical anomalies extend towards prediction of the stock prices based on the past trends and relevant historical information. Normally technical analysis uses some techniques including strategies such as 'resistance support', as well as 'moving averages' (Latif et. al, 2011). Fundamental anomalies pertain to semi strong-form of market efficiency whereas Calendar and Technical anomalies are related to the weak-form of market efficiency.

1.2 Calendar Anomalies

Calendar anomalies imply that stock returns perform different to the efficient market hypothesis in a different period of the year, or on different months of a year or on any specific days of the week. Some calendar effects are defined as (Kumar and Jawa, 2015): Days-of-the-week effect is related to the "substantial variation in mean of returns for different days of the week". Months-of-the-year effect is related to the "substantial variations in the mean of returns for specific months of the year", i.e. 'specific months generate a significantly different (higher or lower) return in comparison to other remaining months in the year'. Weekend effect is the observation that mean returns on first days of week i. e. Mondays are the smallest and sometimes even negative, while mean returns on Fridays, last days of the week, are positive and highest as compared to the returns on other days-of-the-week. Turn-of-the-year effect also known as January effect pertains to the seasonal pattern in the stock markets related with growing trading volumes and comparatively higher stock prices in the last one week of December and the first two weeks of January. January effect was first propounded by Watchel (1942) and later on developed by Rozeff and Kinney (1976)

LITERATURE REVIEW

The literature with respect to the calendar anomalies dates back to the 19th century. It has been discussed below:

2.1. Days-of-the-Week Effect:

It was originally analyzed by Gibbons & Hess (1981), Lakonishok & Levi (1980), Keim & Stambaugh (1983) and Jaffe & Westerfield (1985). They reported that in the US that typically means returns received are lower on Mondays in comparison with the other days of the week. While higher and abnormal means returns were found on last days of the week, Friday as compared to the mean returns on other days of the week. Jaffe et. al. (1985) testified significantly negative low mean returns on Mondays in contrast to other week-days in the US and many other countries. Chanet. al. (2004) observed that the well-known Mondays effect is stronger in stock with comparatively low institutional holdings.

Lakonishok & Maberly (1990) recognized that the retail investors incline to increase trading activity (especially sell transactions) on first days-of-week i.e. Mondays. It indicates that Mondays effect could be the trading pattern of individual/retail investors. There are some differences in the weekdays effect in some countries. Jaffe and Westerfield (1985) for Australia and Japan and Balban (1995), for the Istanbul stock exchange and found significantly lower negative returns on second days-of-week i.e. Tuesdays rather than on Mondays. Negative effect on Tuesdays was commonly witnessed in Asian countries and European. Arsad and Coutts (1996) found that "overall trend of the stock market is a significant variable in determining the presence of days-of-the-week effect". Kumari and Mahendra (2006) calculated the days-of-the-week effect in Indian stock market BSE and NSE; they observed higher returns on Mondays and relatively negative returns on Tuesdays.

2.2. Months of the Year-Effect

Although significant variations are found in the behavior of stock returns in different countries for different months-of-the-year, generally the returns are found high in the months of January in many countries of the world including the US. Therefore, this effect is also known as the January effect. Although Wachte (1942) provided "the initial evidence of the abnormal stock returns in the months of January for US stock markets", Rozeff & Kinney (1976) were the first who properly identified this particular effect in the US stock market and they established that the mean returns on weighted index of NYSE stocks were significantly higher in the months of January as compared to the other months-of-the-year. Similar results were reported from other parts of the world. Agrawal and Tondon (1994) stated monthly anomalies in eighteen countries except for the US. Studies by Blume Stambaugh and Keim (1983) examined the interaction between months-of-the-year and size-of-the-firm effect and found that there is a substantial negative relationship between the size of the firm and stock returns as calculated by the 'total market value of outstanding equity' in their empirical results of the study. They concluded that the mean returns of comparatively small firms were significantly higher than those of large firms in the months of January. Brown et al., studied the months-of-the-year effect in Australia and they found that in Australia returns were abnormally high in months of July along with January. He linked the July-effect with the implication of tax payments because at the end of July, tax is payable in Australia. Presence of calendar anomalies is inconsistent to the notion of market efficiency.

RESEARCH METHODOLOGY

3.1 Objectives of the Study:

3.1.1 To examine the days-of-the-week effect in the returns of BSE Sensex30 and NIFTY 50 indices.

3.1.2 To examine the months-of-the-year effect in the returns of BSE Sensex30 and NIFTY 50 indices.

3.1.3 Hypothesis of the Study:

(i) H0: $\beta1 = \beta2 = \beta3 = \beta4 = 0$

H1: At least one βi is different

(ii) H0: $\beta1 = \beta2 = \beta3 = \beta4 = \beta5 = \beta6 = \beta7 = \beta8 = \beta9 = \beta10 = \beta11 = 0$

H1: At least one Yi is different

3.2 Data collection and its Sources

The data for this study comprises of daily and monthly adjusted closing prices of BSE Sensex 30 index and NSE NIFTY50 index for the period 2013-2017 from yahoo finance for studying the above objectives.

3.3 Methodology

In this study, firstly the log returns of the index prices are calculated as given below:

$R(t) = \log [I(t) / I(t-1)]$

Where I(t) refers to the index price on days t.

Log returns are converted into annualized returns by multiplying by average observations per year during the study.

Firstly, Descriptive statistics has been calculated to ensure the normal distribution of the error term. Further, Augmented Dickey-Fuller test has been used to check the stationarity of the data.

Thereafter, the existence of days-of-the-week effect and months-of-the-year of NIFTY 50 and BSE

SENSEX have been tested using dummy variables in the regression model.

For examining the Days-of-the-week effect, following regression model with dummy variable is used:

$\alpha + \beta 1$ Mondays + $\beta 2$ Tuesdays + $\beta 3$ Wednesdays + $\beta 4$ Thursdays + €

$\alpha + \beta 1$ Mondays + $\beta 2$ Tuesdays + $\beta 3$ Wednesdays + $\beta 4$ Thursdays + €

The variables, Mondays, Tuesdays, Wednesdays and Thursdays are defined as:

If trading days are Mondays, then Days = 1, otherwise 0.

If trading days are Tuesdays, then Days = 1, otherwise 0.

If trading days are Wednesdays, then Days = 1, otherwise 0.

If trading days are Thursdays, then Days = 1, otherwise 0.

Fridays are represented by α.

Similarly, to examine the Months-of-the-Year effect, the following regression model with a dummy variable is used:

$\alpha + \beta 1$ January + $\beta 2$ February + $\beta 3$ March + $\beta 4$ April + $\beta 5$ May + $\beta 6$ June + $\beta 7$ July + $\beta 8$ August $\beta 9$ September + $\beta 10$ October + $\beta 11$ November + €

The variables January, February, March, April, May, June, July, August, September, October, November and December are defined as:

If trading days are in January, then Months = 1, otherwise 0.

If trading days are in February, then Months = 1, otherwise 0.

If trading days are in March, then Months = 1, otherwise 0.

If trading days are in April, then Months = 1, otherwise 0.

If trading days are in May, then Months = 1, otherwise 0.

If trading days are in June, then Months = 1, otherwise 0.

If trading days are in July, then Months = 1, otherwise 0.

If trading days are in August, then Months = 1, otherwise 0.

If trading days are in September, then Months = 1, otherwise 0.

If trading days are in October, then Months = 1, otherwise 0.

If trading days are in November, then Months = 1, otherwise 0.

December is represented by α.

Here, to measure the significance of the differences in the returns of the days-of-the-week and months-of-the-year, Wald Test has been applied on the Nifty 50 and BSE Sensex indices. The results of the Wald test will help in identifying the days-of-the-week and months-of-the- year effect.

In Wald Test, The Null Hypothesis to identify the Days-of-the-week in BSE SENSEX and NIFTY 50 indices series can be represented as:

H0: C(2)=C(3)=C(4)=C(5)

H1: At least one is different

Where, C (2) is represented as Mondays, C (3) as Tuesdays and so on.

Similarly, for the months-of-the-year effect in BSE SENSEX and NIFTY 50 indices series can be represented as:

H0:
C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10) =C(11)=C(12)

H1: At least one is different

Where, C (2) is represented as January, C (3) as February and so on.

4. Analysis and Interpretation

Firstly, to check the statistics of original series and return series, descriptive statistics was calculated. The results are reported in Table 1. There is no huge difference in the average returns of Nifty50 and BSE30 Sensex in data set of study. As the Nifty50 and BSE30 Sensex original series log returns and annualized log returns are not normally distributed as evident from the coefficient of skewness and kurtosis, instead of mean returns, median returns can be used to represent the returns of Nifty50 and BSE30 Sensex which are better than the mean returns. The median returns of BSE30 Sensex are better than that of Nifty.

Table 1: Descriptive Statistics

Summary Statistics	NIFTY			BSE SENSEX		
	Original Series	Log Returns Series	Annualized Log Returns	Original Series	Log Returns Series	Annualized Log Returns
Mean	7850.375	0.000461	0.112732	25803.48	0.000447	0.109338
Median	8059.000	0.000502	0.122900	26519.07	0.000593	0.145242
Standard Deviation	1321.413	0.009231	2.257815	4061.772	0.009062	2.218404
Minimum	5285.000	-0.060973	-14.91390	17905.91	-0.061197	-14.98105
Maximum	10531.50	0.037380	9.143079	34056.83	0.037035	9.066075
Skewness	-0.107841	-0.396692	-0.396692	0.195752	-0.385326	-0.385326
Kurtosis	2.177661	5.886584	5.886584	2.174795	5.916443	5.916443

The conventional measure of variability and volatility in returns is the standard deviation. The standard deviation is more in case of Nifty log returns as compared with BSE Sensex. Thus, it is evident from the statistical analysis that Nifty50 is more volatile as compared to BSE Sensex. Hence investment in Nifty is at more risk than investment in BSE Sensex.

In time series econometrics, it is customary to check whether the series is stationary or not 'before using it in regression analysis in order to avoid spurious regression'. In the analysis all the series were tested for stationarity with the help of the Augmented Dickey-Fuller Test. The results of the ADF test are reported in Table 2. It shows that the null of unit root can be rejected at the conventional level of 1%, 5% and 10% in both the case of Nifty as well as BSE Sensex. Thus, analysis of stock market anomaly is based on annualized log return series of Nifty and BSE Sensex, as they both are stationary.

Table 2: Results of the ADF Test

Series	NIFTY			BSE SENSEX		
	Original Series	Log Returns Series	Annualized Log Returns Series	Original Series	Log Returns Series	Annualized Log Returns Series
Level	t-Statistic -0.463708 Prob.* 0.8955	t-Statistic -31.66016 Prob.* 0.0000	t-Statistic -31.66016 Prob.* 0.0000	t-Statistic -0.604668 Prob.* 0.8670	t-Statistic -31.86032 Prob.* 0.0000	t-Statistic -31.86032 Prob.* 0.0000

**MacKinnon (1996) critical one-sided p-values for rejection of Hypothesis of a unit root at 1%, 5% and 10% are -3.435545, -2.863722 and -2.567982 respectively.*

In this study, a model is estimated to study the days-of-the-week effect in Nifty as well as BSE Sensex.

Table 3: Results of Nifty Days-of-the-Week (Annualized Log Return Series)

Variable	Coefficient	t-statistics	P-Value
Intercept	0.210233	1.436447	0.1511
Mondays	0.004716	0.022925	0.9817
Tuesdays	-0.340045	-1.661343	0.0969
Wednesdays	-0.096514	-0.470603	0.6380
Thursdays	-0.048508	-0.236055	0.8134
R-squared = 0.003218, Adjusted R-squared= -0.000055, S.E. of regression = 2.257878F-statistic = 0.983141(0.415638) Durbin-Watson stat = 1.803432 Note: Figure in () is P-value			

Table 3 represents the results of Nifty. The benchmark day is Friday, which is represented by intercept and provided 'an average return of 0.210 percent on an average during the period of study'. 'Returns of Mondays, Tuesdays, Wednesdays and Thursdays can be found out by deducting the coefficient of these days from the benchmark days, that is, Fridays which were 0.205517, 0.550278, 0.306747and 0.258741percent respectively'. The coefficient of first days-of-week i.e. Mondays is not significant at 5% level of significance which means that there is no weekend effect in Nifty50 Returns. Further, other coefficients for the rest of the days-of-the-week are also not significant at traditional level of significance of 5 percent which indicates that there is no days-of-the-week effect in the Nifty returns. Both R2&AdjustedR2 are very low and F-statistics signifies that the overall model fit is not very strong. The result of Durbin-Watson Statistics of 1.80 states that there is a chance of autocorrelation in the residuals. The results are very clear that there is no days-of-the-week effect in Nifty.

Table 4: Results of the Wald Test: Nifty Days-of-the-Week

Wald Test: Nifty Days-of- the-Week			
Test Statistic	Value	Df	Probability
F-statistic	1.127174	(3, 1218)	0.3369
Chi-square	3.381521	3	0.3365
Null Hypothesis: C(2)=C(3)=C(4)=C(5)			

The results of the Wald test in Table 4 'indicate that there is no significant difference among the returns of different days-of-the-week in Nifty'. Both F-Statistics and Chi-Square are more than 0.05 it means null hypothesis is not rejected which states that there is no significant difference in the Nifty log returns of different days-of-the-week.

Table 5: Results of BSE Sensex Days-of-the-Week (Annualized Log Return Series)

Variable	Coefficient	t-statistics	P-Value
Intercept	0.184172	1.280531	0.2006
Mondays	0.020251	0.100077	0.9203
Tuesdays	-0.301077	-1.496851	0.1347
Wednesdays	-0.079638	-0.395930	0.6922
Thursdays	-0.007022	-0.034772	0.9723
R-squared =, 0.002892 Adjusted R-squared=, -0.000380 S.E. of regression = 2.218825 F-statistic= 0.883956 (0.472788) Durbin-Watson stat = 1.815156 Note: Figure in () is P-value			

Table 5 represents the results of BSE Sensex. The benchmark day is Fridays which is represented by intercept and provided 'an average return of 0.1841percent on an average during the period of study'. 'Returns of Mondays, Tuesdays, Wednesdays and Thursdays can be found out by deducting the coefficient of these days from the benchmark days, that is, Fridays which were0.1639, 0.4852, 0.2638, and 0.1912 percent respectively'. The coefficient of first days-of-week i.e. Mondays is not significant at 5% level of significance which means that there is no weekend effect in Sensex Returns. Further, other coefficients for the rest of the days-of-the-week are also not significant at traditional level of significance of 5 percent which indicates that there is no days-of-the-week effect in the Sensex returns. Both R2&AdjustedR2 are very low and F-statistics signifies that the overall model fit is not very strong. The result of Durbin-Watson Statistics of 1.81 states that there is a chance of autocorrelation in the residuals. The results are very clear that there is no days-of-the-week effect in Sensex.

Table 6: Results of Wald Test: BSE Sensex Days-of-the-Week

Wald Test: BSE Sensex Days-of-the-Week			
Test Statistic	Value	Df	Probability
F-statistic	1.066582	(3, 1219)	0.3623
Chi-square	3.199745	3	0.3618
Null Hypothesis: C(2)=C(3)=C(4)=C(5)			

Wald test was also applied in BSE Sensex. During the period of study, it is tested that is there any significant difference in the dummy variables calculated for the days-of-the-week. The results of the Wald test in Table 6 specify that there is no significant difference among the log returns of different days-of-the-week in BSE Sensex. Both F-Statistics and Chi-Square are more than 0.05 it means null hypothesis is not rejected which states that there is no significant difference in the BSE Sensex log returns of different days-of-the-week.

In this study, the seasonal effect of Nifty and BSE Sensex log returns was also examined by using monthly data. Table 7 and Table 9 explain the same effect.

Table 7: Results of Nifty Months-of-the-Year (Annualized Log Return Series)

Variable	Coefficient	t-statistics	P-Value
Intercept	0.023455	0.107533	0.9144
January	0.046256	0.148521	0.8820
February	-0.189941	-0.602097	0.5472
March	0.355267	1.137873	0.2554
April	0.063642	0.198392	0.8428
May	0.407833	1.322144	0.1864
June	0.032810	0.106118	0.9155
July	0.233976	0.762024	0.4462
August	-0.228512	-0.731893	0.4644
September	0.005717	0.018356	0.9854
October	0.510917	1.610829	0.1075
November	-0.183715	-0.582360	0.5604
R-squared = 0.010407,		Adjusted R-squared= 0.001418,	
S.E. of regression = 2.256214		F-statistic = 1.157764 (0.312299)	
Durbin-Watson stat = 1.821266			
Note: Figure in () is P-value			

The results of the equation for months-of-the-year effect of annualized log returns of Nifty are presented in Table 7. The benchmark month in the model is December which is 'represented by the intercept' which provides very less returns in data set of study. None of the coefficients is significant which rejects the presence of months-of-the-year effect in Nifty log returns. R2 and Adjusted R2 are very low and F Statistics signifies that the model fit is poor. D-W statistics of 1.82 signifies that there is a chance of autocorrelation in the residuals. With this analysis, it can be concluded that there is no months-of-the-year effect in the log returns of Nifty.

Table 8: Results of the Wald Test: Nifty Months-of-the-Year

Wald Test: Nifty Months-of-the-Year			
Test Statistic	Value	Df	Probability
F-statistic	1.255181	(10, 1211)	0.2512
Chi-square	12.55181	10	0.2498
Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10)=C(11)=C(12)			

Table 8 represents the analysis of the Wald Test for Nifty. C(2) represents the months of January, C(3) represents the months of February and so on. The purpose of the test was to study that is there any significant difference in the dummy variables calculated for the months-of-the-year. The results of the Wald test in Table 8 indicate that there is no significant difference among the log returns of different months of the year in Nifty. Both F-Statistics and Chi-Square are more than 0.05 it means the null hypothesis is not rejected which states that there is no significant difference in the Nifty returns of different months-of-the-year.

Table 9: Results of BSE Sensex Months of the Year (Annualized Log Return Series)

Variable	Coefficient	t-statistics	P-Value
Intercept	0.001099	0.005080	0.9959
January	0.060214	0.196391	0.8443
February	-0.157193	-0.504987	0.6137
March	0.333989	1.084003	0.2786
April	0.057468	0.182102	0.8555
May	0.458485	1.506027	0.1323
June	0.075187	0.246397	0.8054
July	0.260735	0.860378	0.3898
August	-0.209223	-0.680738	0.4962
September	-0.001497	-0.004870	0.9961
October	0.547168	1.748403	0.0806
November	-0.143426	-0.460762	0.6451
R-squared = 0.010951, Adjusted R-squared= 0.001975, S.E. of regression = 2.216212F-statistic = 1.219970 (0.268271) Durbin-Watson stat = 1.834093 Note: Figure in () is P-value			

The results of the equation for months-of-the-year effect of annualized log returns of Sensex are presented in Table 7. The benchmark month in the model is December which is 'represented by the intercept' which provides very less returns in data set of study. None of the coefficients is significant which rejects the presence of months-of-the-year effect in Sensex log returns. R2 and Adjusted R2 are very low and F Statistics signifies that the model fit is

poor. D-W statistics of 1.83 signifies that there is a chance of autocorrelation in the residuals. With this analysis, it can be concluded that there is no months-of-the-year effect in the log returns of Sensex.

Table 10: Results of the Wald Test: BSE Sensex Months-of-the-Year

Wald Test: BSE Sensex Months-of-the-Year			
Test Statistic	Value	Df	Probability
F-statistic	1.314571	(10, 1212)	0.2171
Chi-square	13.14571	10	0.2156
Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10)=C(11)=C(12)			

Table 10 represents the analysis of the Wald Test for BSE Sensex. C(2) represents the months of January, C(3) represents the months of February and so on. The purpose of the test was to study that is there any significant difference in the dummy variables calculated for the months-of-the-year. The results of the Wald test in Table 10 signify that there is no significant difference among the returns different months-of-the-year in BSE Sensex. Both F-Statistics and Chi-Square are more than 0.05 it means null hypothesis is not rejected which states that there is no significant difference in the BSE Sensex returns of different months-of-the-year.

CONCLUSION

In this study, an attempt to identify the Days-of-the-Week Effect and Months-of-the-years Effect has been made in the BSE SENSEX and NIFTY 50 indices as these majorly represent the key Indian Stock Market. According to the study, no significantly different returns were found on any days-of-the-week in both the indices. Similarly, no significantly different returns were found on any months-of-the-year effect. The study was supported by Wald Tests. Therefore, no calendar anomaly with respect to the days-of-the-week and months-of-the-year was identified.

Future Research Directions

Future research can be undertaken by identifying the presence of another calendar anomalies namely Turn of the Months or abnormal returns around any festivals. An attempt can be made to identify the presence of fundamental and technical anomalies. Further, a longer time period of study or different set of indices may provide a different set of results.

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