Existence of Day-of-the-Week Effect in Returns of Some Selected Indices of the Indian Stock Market

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Abstract

The present study attempted to measure day-of-the-week effect on the returns and volatility of Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) indices for the period from 2005 through 2014. Along with the descriptive statistics, *t*-test and ANOVA were used to capture mean deference in returns for the trading days Monday through Friday. Mean returns of only one index, Nifty Junior, were found statistically significant while using *t*-test ; whereas, no such difference was observed in any of the index (BSE and NSE) in ANOVA. To confirm the findings of *t*-test and ANOVA, an econometric model AR (1)-GARCH (1, 1) was used. In contrast to the findings of the other indices, returns on Monday for BSE small cap were found to be statistically significant. It was also observed that volatility on Monday for returns on BSE small cap were statistically significant. Returns on Tuesday, for BSE small cap and BSE mid cap, were found to be negative and statistically significant. Returns on these two indices were also found to be negatively volatile on Tuesday. Wednesday effect was only observed for Nifty Junior, but no volatility was captured on Wednesday for Nifty Junior. Returns on Nifty Junior were also found to be positive and statistically significant on Friday, but volatility was captured for returns on Nifty Junior on Friday.

Keywords : calendar anomaly, day-of-the-week effect, volatility, ANOVA, auto regression, GARCH

JEL Classification : C12, C58, G11, G14

Paper Submission Date : October 19, 2016 ; Paper sent back for Revision : December 14, 2016 ; Paper Acceptance Date : March 22 , 2017

Calendar anomaly is a phenomena in the financial markets in which returns on stocks or stock indices are found abnormal. Calendar anomalies state that the stock return is abnormally high on some specific day, period, or point of time. Though in many developed markets, calendar anomalies disappeared, but still, there are many developing markets where these anomalies exist in many forms, that is, day-of-the-week effect, week-of-the-month effect, turn-of-the-month effect, January effect, and holiday effect etc.

Day of the month effect is one of the most common calendar anomalies found in the financial market. This anomaly states that returns on stocks and stock indices are not the same for all the trading days of the week. It is noticed in previous studies that average returns on Monday are lower than the average returns on other trading days of the week. On the other hand, it was also observed that returns on Friday are higher than the returns on other trading days of the week, though, such observations are not the same throughout the world. Some variations are found in other countries. In Australia and Japan, Tuesday was found to have lower returns than other trading days of the week. It is known as Tuesday effect in these countries.

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Though, several studies have been conducted to examine the existence of day-of-the-week effect on the Indian stock market, all of these have been conducted using two major indices, that is, NSE NIFTY and BSE SENSEX. However, in his recent study, Raghuram (2017) investigated the month-of-the-year effect taking the indices of NSE and BSE, but no other study has been conducted to investigate the day of the week effect on returns using all the indices of BSE and NSE as per our knowledge.

Keeping the above variations regarding the day-of-the-week effect and research gap in mind, this study makes an attempt to examine the existence of day of the week effect in the Indian stock market taking some major indices of BSE and NSE.

Review of Literature

Day-of-week effect is a phenomenon in which stock returns show significantly different returns on some specific day of the week. It was first documented by Osborne (1962) in the United States (U.S.) stock market, and subsequently analyzed by Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishok and Maurice (1982), Smirlock and Starks (1983), Keim and Stambaugh (1984), Rogalski (1984), Jaffe and Westerfield (1985), and Jacobs and Levy (1988). French (1980) addressed this as the weekend effect and pointed out that the returns on Fridays were positive while the returns on Monday were abnormally negative. He pointed out that this effect came from the fact that normally, the firm would announce unfavorable news on weekends to avoid panic selling of stocks. Damodaran (1989) showed that news announced on Fridays tended to be more negative than other weekdays. Usually, the bad news came out after the market had closed on Friday, so the effect spilled over to the next trading day, which is Monday. However, he pointed out that this could account for only a part of the weekend effect. Without the bad news announcement on Friday, the returns on Monday were still less than the other weekdays.

In the U. S., typically low mean returns are observed on Monday in comparison to the rest of the days of the week. Mean returns on Friday are observed to be positive and abnormally higher than the mean returns on other days of the week. Wang, Li, and Erickson (1997) observed that in the U.S. market, the well-known Monday effect occurs primarily in the last two weeks of a month. Wang used a long time series from 1962 - 1993 for his empirical research. French (1980), Jaffe and Westerfield (1985), and Ma (1989) reported that the average returns were significantly negative on Monday and these were significantly lower than the average returns for other weekdays in U.S. and many other countries of the world. On the other hand, the average returns on Friday were found to be positive and higher than the average returns for the rest of the weekdays. Das and Jariya (2009), in their study using autoregressive model, found that there was statistically significant day-of-the week-effect in stock returns of the Colombo Stock Exchange for the overall sample period, and Friday returns were significantly higher compared to the other days.

Furthermore, Chan, Leung, and Wang (2004) observed that the well known Monday seasonal was stronger in stocks with low institutional holdings. Lakonishok and Maberly (1990) documented that individual investors tended to increase trading activity (especially sell transactions) on Monday. It indicates that the Monday effect could be related to the trading pattern of individual investors. Jain and Joh (1988) reported that liquidity in the market place was lower on Monday than other days of the week; they reported that total volume of the New York Stock Exchange (NYSE) was approximately 90% of the average trading volume for Tuesday through Friday. Arsad and Coutts (1996) and Steely (2001) found that general trend of the market was an important variable in determining the existence of day-of-the-week effect. Bildik (2004) asserted that low and negative Monday effect disappeared when returns of the last trading day of the previous week were positive. Khanna (2015), in her study on National Stock Exchange (India) that covered 203 companies, found that there was no day-of-the-week effect after liberalization. However, it showed its existence in the pre-liberalization period.

Anomalies do not show the same pattern in all markets. Some variations have been found in day- of-the-week

effect in some countries. Balaban (1995) for Istanbul stock exchange, and Jaffe and Westerfield (1985) for Australia and Japan found negative and lowest returns on Tuesday rather than on Monday. Negative Tuesday effect was mostly observed in European and Asian countries. Furthermore, studies on day-of-the-week effect are not limited to the equity markets of a particular country. Several studies have been conducted to investigate day-of-the-week effect on equity and derivative markets across the world. For example, Aggarwal and Rivoli (1989) ; Athanassakos and Robinson (1994) ; Chang, Pinegar, and Ravichandran (1993) ; Dubois and Louvet (1986) ; Kato and Schallheim (1985) ; and Solnik and Bousquet (1990) found that the distribution of foreign stock returns varied by day of the week, and Corhay, Fatemi, and Rad (1995) ; Flannary and Protopapadakis (1988) ; Gay and Kim (1987) ; and Gesser and Poncet (1997) stated that returns of futures and foreign exchange markets also varied by day of the week.

   However, all of the above studies focused on patterns in mean returns. However, there are some other studies that have been conducted to investigate the time series behavior of stock prices in terms of volatility by using GARCH models. French, Schwert, and Stambaugh (1987) examined the relationship between stock prices and volatility and reported that unexpected stock market returns were negatively related to the unexpected changes in volatility. Glosten et al. (1993) and Nelson (1991) in their study concluded that positive unanticipated returns reduced conditional volatility ; whereas, negative unanticipated returns increased conditional volatility. Baillie and DeGennaro (1990) found no evidence of a relationship between portfolio mean returns and variance. The findings are further supported by Chan, Karolyi, and Stulz (1992) who reported significant foreign influence on the time-varying risk premium for U.S. stocks but found no significant relationship between the conditional expected excess returns on the S&P 500 and its conditional variance. Corhay and Rad (1994) and Theodossiou and Lee (1993) found no significant relationship between stock market volatility and expected returns for major European stock markets.

   While studying the weekend effect of stock returns in the Indian market, Singhal and Bahure (2009) found that there was a significant difference in mean returns on Monday as compared to Friday for the indices BSE SENSEX, BSE 200, and NSE NIFTY.

   Poornima and Chitra (2014), in their recent study on the Indian stock market, found highest mean returns on Friday and the lowest mean returns on Monday for the sample index NSE NIFTY. The analysis of seasonality results pointed out that no significant Friday effect existed in NSE NIFTY during the study period. Amarnani and Vaidya (2014), in their study on calendar anomalies in the Indian stock market, observed negative returns on Monday for NSE NIFTY and positive returns on Monday for BSE SENSEX.

   The findings of most of the studies referred above reported that the expected returns in stock markets are time varying and conditionally heteroskedastic. This study investigates the existence of day of the week effect on various indices of BSE and NSE of the Indian stock market.

Objective of the Study

The present study focuses on the following objective :

✤ To identify day of the week effect on the returns of various indices of NSE and BSE taken for this study.

Hypotheses

The following are the major hypotheses formed to attain the set objectives of this study:

✤ H_{01} : There is no significant difference among the five trading days' returns of the selected indices.

or

$$Rt_{mon} = Rt_{tue} = Rt_{wed} = Rt_{thu} = Rt_{fri}$$

➺ **H_{02}** : There is no day of the week effect in the returns of the selected indices.

Methodology

(1) Sample for the Study : Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) are the two apex barometers of the Indian economy. They indicate the performance of the whole economy. Keeping the importance of these two exchanges, this study includes the indices given in Table 1. The present study covers the period of 10 years from January 1, 2005 to December 31, 2014.

(2) Tools Used for the Study : Continuously compounded daily returns on the indices have been used for this study which are defined as the first difference of logarithmic natural values of adjusted closing prices of the indices. The formula applied to get the percentage returns is as follows:

$$r_t = ln(P_t/P_{t-1})*100$$

Here,
r_t = Return on particular indices for time t,
ln = Logarithmic natural,
P_t = Daily adjusted closing price for time t,
P_{t-1} = Daily adjusted closing price for time t-1.

(3) Descriptive Statistics : Primarily, the data was analyzed using the mean, variance, standard deviation, t-statistics, and F-statistics (ANOVA). To analyze and apply statistical tools, software SPSS 17 was used.

(4) Econometrics Modeling : Though proper care has been taken for extracting the results from descriptive statistics, but for the confirmation of the results derived from the primary analysis, econometrics have been employed in the study. The AR (1) - GARCH (1, 1) model has been used to examine the effect of calendar anomalies. The following models have been used :

$$r_t = c + \rho\, r_{t-1} + \delta Mon_t + e_t$$
$$e_t = u_t\, \sqrt{h_t} u_t \sim N(0, \sigma^2)$$
$$h_t = \omega + \alpha\, \mathbb{C}^2_{t-1} + \beta h_{t-1} + \pi Mon_t \quad \text{..} (1)$$

Table 1. List of Indices Taken in the Study

Bombay Stock Exchange	National Stock Exchange
BSE Sensex	CNX NIFTY
BSE 100	CNX 100
BSE 200	CNX 200
BSE 500	CNX 500
BSE Mid Cap	CNX Mid Cap
BSE Small Cap	CNX Nifty Junior

In the above equation, the first equation is known as mean equation, whereas the second equation is known as a variance equation. The second line establishes a link between mean and conditional variance. The mean equation signifies that the returns generating process is assumed to follow AR (1) process ; therefore, today's returns are dependent on yesterday's returns through coefficient ρ. Such dependence is generally observed in empirical research.

In variance equation, the conditional variance for a given day h_t depends on yesterday's squared residuals ($\mathcal{C}^2_{t-1}$) through coefficient α and on yesterday's conditional variance through coefficient β. In this standard GARCH (1, 1) model, coefficient α is called the news coefficient, while coefficient β governs the persistence of volatility. To ensure consistency in volatility estimation, both the coefficients should be non-negative and their sum must be less than 1.

This standard AR (1) - GARCH (1, 1) model is augmented by the dummy variable mon_t. This is Monday dummy and takes the value of '1' on Monday and '0' on other days. In the mean equation coefficient, δ_1 captures the Monday effect. If this coefficient is positive and significant, it implies that the returns on Monday are significantly higher than the returns on other days of the week. On the other hand, if δ_1 is negative and significant, it implies that Monday returns are lower than the returns on other week days. A non-significant δ_1 coefficient signifies the absence of Monday anomaly in returns.

Similarly, coefficient π captures the Monday effect in volatility. A positive and significant value of π indicates that volatility increases on Monday, while a negative and significant value of this coefficient is an indicator of reduction in volatility on Monday. A non-significant value will show absence of Monday effect on volatility.

Analysis, Results, and Discussion

To compare the mean returns of the all five days (Monday to Friday) and measure the variance, if any, ANOVA test was applied. The results are discussed in the following paragraphs :

The Table 2 shows that the returns for BSE Sensex, BSE 100, BSE 200, BSE 500 indices are higher on Wednesday than the returns on any other trading day. Further, it is very interesting that the standard deviation as proxy of risk, is less on Wednesday as compared to that on other trading days. For BSE small cap index, mean

Table 2. Day-of-the-Week Effect in Returns for BSE Indices

Weekday	Mean return & standard deviation	BSE Indices					
		BSE Sensex	BSE 100	BSE 200	BSE 500	BSE small cap	BSE mid cap
Monday	$\overline{X}$	0.07	0.07	0.07	0.08	0.15	0.09
	σ	1.81	1.82	1.79	1.77	1.79	1.73
Tuesday	$\overline{X}$	0.03	0.03	0.03	0.03	-0.00	0.00
	σ	1.41	1.42	1.41	1.39	1.47	1.43
Wednesday	$\overline{X}$	0.11	0.10	0.09	0.09	0.10	0.08
	σ	1.47	1.46	1.45	1.42	1.54	1.46
Thursday	$\overline{X}$	0.02	0.01	0.00	0.00	0.02	-0.00
	σ	1.44	1.44	1.42	1.38	1.46	1.36
Friday	$\overline{X}$	0.07	0.08	0.08	0.07	-0.04	0.07
	σ	1.69	1.65	1.62	1.58	1.45	1.44
Average $\overline{X}$	$\overline{X}$	0.06	0.06	0.05	0.05	0.05	0.05
Average σ	σ	1.57	1.57	1.54	1.52	1.55	1.49
F-Test	F	0.26	0.25	0.27	0.27	1.20	0.47
	P	0.90	0.91	0.90	0.90	0.31	0.76

Table 3. Day-of-the-Week Effect in Returns for NSE Indices

Weekday	Mean return & standard deviation	NSE Indices					
		NSE Nifty	NSE 100	NSE 200	NSE 500	NSE Nifty mid cap	NSE Nifty Junior
Monday	$\overline{X}$	0.06	0.09	0.06	0.07	0.09	0.07
	σ	1.82	1.47	1.80	1.77	1.75	1.74
Tuesday	$\overline{X}$	0.03	0.02	0.03	0.03	0.01	**0.11**
	σ	1.42	1.42	1.41	1.39	1.42	1.60
Wednesday	$\overline{X}$	**0.09**	0.03	**0.09**	**0.09**	0.09	-0.09
	σ	1.46	1.55	1.43	1.42	1.45	1.63
Thursday	$\overline{X}$	0.02	**0.12**	0.00	-0.00	-0.01	0.08
	σ	1.47	1.59	1.43	1.41	1.41	1.69
Friday	$\overline{X}$	0.08	0.02	0.08	0.08	**0.11**	**0.12**
	σ	1.67	1.80	1.60	1.56	1.48	1.95
Average $\overline{X}$	$\overline{X}$	0.06	0.06	0.05	0.05	0.06	0.06
Average σ	σ	1.57	1.57	1.54	1.52	1.51	1.73
F-Test	F	.17	.40	.28	.32	.69	1.24
	P	.95	.81	.89	.86	.60	0.29

Source: Data collected from official website of NSE, analyzed and tabulated for the present study by the authors.

returns are high on Monday (0.15) as compared to the mean returns on other trading days. But it also has higher standard deviation (1.79). For BSE mid cap, the mean returns on Monday are higher (0.09) than they are on other trading days, with higher standard deviation (1.73) followed by Wednesday (0.08). The findings also reveal that returns on Monday and Friday are higher than the average returns of the week for all the BSE indices taken in this study, except the returns on BSE small cap, which has negative returns on Friday (-0.04). The results also show that returns on Thursday are lowest for all the BSE indices followed by Tuesday. Investors can avoid their intraday trading on that day. However, the study finds that there is a difference in mean returns on the indices across days, but the difference is not statistically significant. No p - value of the F test is found to be less than 0.05 for any of the BSE indices. Therefore, the findings fail to reject our first null hypothesis H_{01}.

The Table 3 shows that the results of the ANOVA worked out for the NSE indices. Results show that the returns on NSE Nifty, NSE 200, and NSE 500 are higher (0.09, 0.09, and 0.09, respectively) on Wednesday followed by returns on Friday (0.08, 0.08, and 0.08, respectively). For NSE 100, returns are higher on Thursday (0.12) followed by returns on Monday (0.09). Returns for Nifty Mid Cap and Nifty Junior are higher on Friday (0.11 and 0.12, respectively) followed by Monday (0.09) for Nifty mid cap and Tuesday (0.11) for Nifty Junior.

Similar to the outcome of the ANOVA worked out for the BSE indices, the outcome of the ANOVA worked out for the NSE indices shows that returns on Thursday are lowest for NSE Nifty, NSE 200, NSE 500, and NSE Nifty mid cap followed by Tuesday. However, returns on Nifty Junior are lowest on Wednesday (- 0.09).

It is an interesting observation for the NSE indices that the standard deviation, as a proxy of risk, is comparatively less for the day when returns are higher except NSE Nifty Junior. However, the results show the difference in mean returns for different trading days, but it is not found to be statistically significant for any of the NSE indices. Therefore, the findings fail to reject our second null hypothesis H_{02}.

Independent sample t-test has been performed to check whether there is any significant difference between mean returns on a particular day and mean returns on other trading days. For this purpose, five dummy variables on the name of five week days, that is, Monday dummy, Tuesday dummy, Wednesday dummy, Thursday dummy, and Friday dummy were created. Outcomes of the t-test also support the results obtained from ANOVA, which

Table 4. Independent Sample *t* - Test for BSE and NSE Indices

Index	Tuesday Dummy	N	X̄	σ	t	p
BSE small cap	1	499	-0.00	1.47		
	0	1969	0.06	1.57	-0.79	0.43
Wednesday Dummy						
NSE Nifty Junior	1	494	-0.09	1.63		
	0	1974	0.09	1.75	-2.16	**0.03**
Thursday Dummy						
NSE 500	1	489	-0.00	1.41		
	0	1979	0.07	1.54	-0.88	0.38
NSE Mid Cap	1	489	-0.01	1.41		
	0	1979	0.07	1.53	-1.15	0.25
BSE Mid Cap	1	489	-0.00	1.36		
	0	1979	0.06	1.53	-0.88	0.38
Friday Dummy						
BSE Small Cap	1	489	-0.03	1.45		
	0	1979	0.07	1.57	-1.31	0.19

have been presented in the Table 2 and Table 3, respectively. Results of *t* - test show that returns on Thursday are negative for CNX 500(- 0.00), CNX Mid Cap (-0.01), and BSE Mid Cap (-0.00) ; whereas, returns on Tuesday and Friday are negative for BSE Small Cap (-0.00 and -0.03 respectively). However, there is a difference in mean returns on a particular trading day and average mean returns of other trading days, but the difference in mean returns is statistically significant only for Nifty Junior ($t = -2.16, p = 0.03$) on Wednesday. NSE Nifty Junior shows negative returns (-0.09) on Wednesday. Hence, findings of *t* statistics reject our null hypothesis for one index-NSE Nifty Junior- in case of returns on Wednesday. The results are given in the Table 4.

Day of the Week Effect - Econometric Models

The confirmatory statistics were applied to confirm whether the results discussed in the preceding section are valid or not. It is assumed that the results are only valid when the variables under consideration are identically distributed Gaussian variables. However, this assumption is not valid for the asset returns because the asset returns are found to be autoregressive and usually show volatility clustering. Therefore, the true nature of the seasonal anomalies cannot be known unless the adjustment is made for conditional mean and volatility. We use the AR (1) - GARCH (1, 1) for this purpose and then include the dummy-variables in mean and variance equations to examine the presence of anomaly.

(1) Monday Effect : For the examination of the Monday effect in returns and volatility, one dummy variable representing the Monday effect is included in the following AR(1) - GARCH (1,1) model :

$$r_t = C + \rho\, r_{t-1} + \delta_1 Mon_t + e_t$$
$$e_t = u_t\, \sqrt{h_t}\, u_t \sim N(0,1)$$
$$h_t = \omega + \alpha \varepsilon^2_{t-1} + \beta h_{t-1} + \pi Mon_t \quad \text{...................................(1)}$$

where, R_t is the return on a particular index. Mon_t is the dummy variable for Monday. It takes the value of 1 for

Table 5. Econometric Model at Index Level to Check Monday Effect on Returns and Volatility

Indices	Statistics	Mean equation			Variance equation				
		C	AR	Mon_t	C	α	β	Mon_t	Ad. R^2
BSE Sensex	Coeff.	0.08	0.08	0.04	0.03	0.09	0.89	-0.04	0.01
	t-test	3.29**	3.64**	0.73	2.41*	12.09**	111.38**	-0.59	
BSE 100	Coeff.	0.08	0.10	0.04	0.03	0.1	0.88	-0.02	0.01
	t-test	3.23**	4.39**	0.77	2.42*	12.34**	104.39**	-0.24	
BSE 200	Coeff.	0.08	0.11	0.05	0.03	0.1	0.88	-0.02	0.01
	t-test	3.19**	4.95**	0.99	2.58*	12.56**	102.01**	-0.28	
BSE 500	Coeff.	0.08	0.12	0.05	0.03	0.10	0.88	-0.01	0.01
	t-test	3.22**	5.54**	1.03	2.58*	12.74**	101.14**	-0.19	
BSE Small Cap	Coeff.	0.03	0.28	0.15	0.05	0.17	0.80	0.14	0.08
	t-test	1.34	13.71**	**2.84****	2.74**	12.79**	65.26**	1.97*	
BSE Mid Cap	Coeff.	0.07	0.21	0.07	0.03	0.15	0.83	0.14	0.04
	t-test	2.81*	10.49**	1.27	2.00*	13.93**	90.79**	7.89**	
CNX NIFTY	Coeff.	0.08	0.07	0.04	0.04	0.10	0.89	-0.06	0.00
	t-test	3.14**	3.36**	0.79	2.71**	12.13**	105.92**	-0.83	
CNX 100	Coeff.	0.08	0.08	0.02	0.08	0.10	0.81	-0.26	0.00
	t-test	3.33**	3.73**	0.53	4.93**	12.07**	100.29**	-3.35**	
CNX 200	Coeff.	0.08	0.10	0.05	0.03	0.11	0.88	0.09	0.01
	t-test	3.07**	4.77**	0.89	2.24*	12.56**	104.55**	0.13	
CNX 500	Coeff.	0.07	0.19	0.05	0.04	0.13	0.84	0.06	0.01
	t-test	3.07**	5.15**	0.92	2.15*	12.59**	105.84**	0.20	
CNX Mid Cap	Coeff.	0.07	0.019	0.05	0.04	0.13	0.84	0.06	
	t-test	2.78**	9.18**	0.96	2.63**	13.96**	92.29**	0.80	
CNX Nifty Junior	Coeff.	0.09	0.15	-0.06	0.06	0.11	0.88	-0.13	0.02
	t-test	3.38**	7.25**	-1.04	3.03**	12.33**	110.30**	-1.36	

Note: **$p < 0.01$, * $p < 0.05$.

Monday and 0 otherwise. If Monday effect on returns is present, then the δ_1 coefficient in equation 1 must be statistically significant. Similarly, coefficient π indicates the presence of Monday effect on volatility. The results are presented in the Table 5.

It was observed in the preceding studies that returns and volatility in returns on Monday for all the BSE indices is influenced by its own AR (1), ARCH, and GARCH factors or its own shocks. The present study shows that in mean equation, coefficient of AR (1), which is ρ, is positive and statistically significant at the 1% significance level for all the BSE and NSE indices. It means that today's returns of all the BSE and NSE indices are influenced by yesterday's returns of these indices. ARCH term (α) and GARCH term (β) for all the indices is also positive and statistically significant at the 1% significance level. In the mean equation, coefficient of Monday dummy, which is δ_1, is positive and statistically significant only for BSE small cap at 1% significance level. It means that the Monday effect is present in the returns of BSE Small Cap. Returns on Monday for BSE Small Cap are significantly higher than it is for other days. Hence, the finding rejects our null hypothesis $H_{02(a)}$ that no Monday effect exists in returns of the BSE Small Cap. The results also reveal that no Monday effect is found in the returns of other BSE and NSE indices. Hence, the null hypothesis cannot be rejected for these indices.

In the variance equation, the coefficient of Monday dummy, which is π, is found to be positive and significant for BSE Small Cap and BSE Mid Cap at 5% and 1% significance levels, respectively. This shows that returns on Monday are more volatile than other days in case of these two indices. Coefficient is negative and significant for CNX Nifty 100 at 1% significance level, which shows that returns on Monday for CNX Nifty 100 are less volatile.

(2) Tuesday Effect : The following equation is used to examine the Tuesday effect :

$$r_t = C + \rho\, r_{t-1} + \delta_1 Tue_t + \varepsilon_t$$
$$\varepsilon_t = u_t \sqrt{h_t} u_t \sim N(0,1)$$
$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} + \pi Tue_t \quad ....(2)$$

Tue_t is the dummy variable for Tuesday in the above equation.

The Table 6 shows the outcome of the regression analysis to measure the Tuesday effect on returns. Results show

Table 6. Econometric Model at Index Level to Check Tuesday Effect on Returns and Volatility

Indices	Statistics	Mean equation			Variance equation				
		C	AR	Tue_t	C	α	β	Tue_t	Ad. R^2
BSE Sensex	Coeff.	0.10	0.08	-0.06	0.09	0.10	0.89	-0.30	0.01
	t-test	4.29**	3.54**	-1.21	5.05**	11.52**	100.97**	-3.77**	
BSE 100	Coeff.	0.1	0.09	-0.06	0.09	0.1	0.88	-0.29	0.01
	t-test	4.14**	4.29**	-1.2	5.29**	11.82**	98.02**	-3.77**	
BSE 200	Coeff.	0.1	0.11	-0.06	0.09	0.11	0.88	-0.28	0.01
	t-test	4.16**	4.87**	-1.25	5.25**	12.09**	96.50**	-3.65**	
BSE 500	Coeff.	0.1	0.12	-0.07	0.09	0.11	0.87	-0.26	0.01
	t-test	4.23**	5.45**	-1.32	5.23	12.35**	96.65**	-3.65**	
BSE Small Cap	Coeffi.	0.09	0.28	-0.14	0.11	0.16	0.81	-0.20	0.08
	t-test	3.56**	13.53**	**-2.71****	6.27**	12.76**	67.54**	-2.89**	
BSE Mid Cap	Coeff.	0.10	0.21	-0.10	0.09	0.14	0.83	-0.17	0.04
	t-test	4.11**	10.43**	**-2.07***	5.44**	13.97**	96.63**	-2.71**	
CNX NIFTY	Coeff.	0.10	0.07	-0.06	0.09	0.10	0.89	-0.29	0.00
	t-test	4.02**	3.26**	-1.08	4.77**	11.5**	97.34**	-3.41**	
CNX 100	Coeff.	0.10	0.09	-0.06	0.06	0.10	0.88	-0.16	0.00
	t-test	4.10**	3.92**	-1.08	3.35**	12.08**	101.60**	-1.84	
CNX 200	Coeff.	0.10	0.10	-0.07	0.09	0.11	0.89	-0.29	0.01
	t-test	4.05**	4.67**	-1.38	5.41**	12.15**	99.43**	-3.84**	
CNX 500	Coeff.	0.10	0.11	-0.07	0.09	0.11	0.88	-0.27	0.01
	t-test	3.79**	9.12**	-1.77	5.06**	13.27**	96.35**	-2.79**	
CNX Mid Cap	Coeff.	0.10	0.19	-0.09	0.10	0.13	0.84	-0.21	0.02
	t-test	3.79**	9.12**	-1.77	5.06**	13.27**	96.35**	-2.79**	
CNX Nifty Junior	Coeff.	0.08	0.15	-0.01	0.13	0.12	0.87	-0.43	0.02
	t-test	2.97**	7.13**	-0.19	5.81**	12.39**	105.46**	-4.51**	

Note: **$p < 0.01$, *$p < 0.05$.

that in the mean equation, coefficient of Tuesday dummy (δ_1) is negative and statistically significant for BSE Small Cap and BSE Mid Cap at 1% and 5 % significance levels, respectively. It indicates that returns on Tuesday for these two indices are significantly lower than the returns of other trading days of the week. In variance equation, coefficient of Tuesday dummy is negative and statistically significant for all the BSE and NSE indices at the 1% significance level except, CNX 100. Coefficient of Tuesday dummy for CNX 100 is not found to be statistically significant in the variance equation, but it is also found to be negative.

(3) Wednesday Effect : The following equation is used to examine the Wednesday effect :

$$r_t = C + \rho\, r_{t-1} + \delta_1 Wed_t + e_t$$
$$e_t = u_t\, \sqrt{h_t} u_t \sim N(0,1)$$
$$h_t = \omega + \alpha \varepsilon^2_{t-1} + \beta h_{t-1} + \pi Wed_t \quad ....(3)$$

Table 7. Econometric Model at Index Level to Check Wednesday Effect on Returns and Volatility

Indices	Statistics	Mean equation			Variance equation				Ad. R^2
		C	AR	Wed_t	C	α	β	Wed_t	
BSE Sensex	Coeff.	0.08	0.08	0.04	0.02	0.09	0.89	0.01	0.01
	t-test	3.45**	3.65**	0.71	1.44	11.92**	108.54**	0.15	
BSE 100	Coeff.	0.08	0.10	0.03	0.04	0.1	0.88	-0.03	0.01
	t-test	3.44**	4.39**	0.59	2.08*	12.20**	1.2.34**	-0.36	
BSE 200	Coeff.	0.08	0.11	0.03	0.03	0.11	0.88	-0.01	0.03
	t-test	3.57**	4.94**	0.48	2.01*	12.41**	100.35**	-0.17	
BSE 500	Coeff.	0.08	0.12	0.03	0.04	0.11	0.88	-0.02	0.01
	t-test	3.56**	5.53**	0.56	2.22*	12.03**	99.81**	-0.31	
BSE Small Cap	Coeff.	0.05	0.28	0.08	0.11	0.17	0.80	-0.17	0.01
	t-test	1.79	13.77**	1.41	5.82**	12.83**	66.18**	-2.11*	
BSE Mid Cap	Coeff.	0.07	0.21	0.04	0.80	0.15	0.83	-0.16	0.04
	t-test	2.87**	10.49**	0.81	4.96**	13.95**	95.07**	-1.94	
CNX NIFTY	Coeff.	0.08	0.07	0.03	0.03	0.10	0.89	0.01	0.00
	t-test	3.40**	3.37**	0.51	1.45	11.87**	102.48**	0.13	
CNX 100	Coeff.	0.09	0.09	-0.01	-0.02	0.10	0.89	0.24	0.00
	t-test	3.74**	3.95**	-0.12	-1.21	12.31**	109.55**	3.24**	
CNX 200	Coeff.	0.08	0.10	0.03	0.04	0.11	0.88	-0.03	0.01
	t-test	3.30**	4.78**	0.63	2.14*	12.46**	103.70**	-0.30	
CNX 500	Coeff.	0.08	0.11	0.04	0.04	0.11	0.88	-0.03	0.01
	t-test	3.36**	5.16**	0.71	2.22*	12.51**	105.30	-0.40	
CNX Mid Cap	Coeff.	0.07	0.19	0.03	0.08	0.14	0.84	-0.13	0.03
	t-test	2.89**	9.15**	0.57	4.29**	13.26**	94.35**	-1.47	
CNX Nifty Junior	Coeff.	0.11	0.15	-0.14	0.00	0.11	0.88	0.18	0.02
	t-test	4.22**	7.28**	**-2.35***	0.08	12.27**	111.29**	1.58	

Note: **$p < 0.01$, *$p < 0.05$

Wed$_t$ is the dummy variable for Wednesday in the above equation.

The Table 7 reveals the outcome of the AR(1) - GARCH (1,1) model which has been run to measure the Wednesday effect on returns. Mean equations show that there is no Wednesday effect in mean returns of any of the BSE and NSE indices except, CNX Nifty Junior. Coefficient of Wednesday dummy for Nifty Junior in mean equations is found to be negative and statistically significant at the 5 % significance level. It shows that returns for CNX Nifty Junior is lower and negative on Wednesday. The results, therefore, reject the null hypothesis H$_{02(b)}$ that there is no Wednesday effect on the returns of CNX Nifty Junior. For the rest of the indices, the results cannot reject this null hypothesis.

In variance equation, volatility in returns is statistically significant only for BSE Small Cap and CNX 100 at 5% and 1% levels of significance, respectively. Volatility for BSE Small Cap is negative ; whereas, volatility for CNX 100 is positive. Overall, the results show that returns are not volatile on Wednesday for the rest of the indices.

(4) Thursday Effect : The following equation is estimated to examine the Thursday effect :

Table 8. Econometric Model at Index Level to Check Thursday Effect on Returns and Volatility

Indices	Statistics	Mean equation			Variance equation				
		C	*AR*	*Thu$_t$*	*C*	*α*	*β*	*Thu$_t$*	Ad. *R^2*
BSE Sensex	Coeff.	0.10	0.07	-0.05	0.01	0.09	0.89	0.09	0.01
	t-test	4.19**	3.64**	-0.94	0.40	12.21**	112.37**	1.22	
BSE 100	Coeff.	0.10	0.09	-0.06	0.01	0.10	0.88	0.08	0.01
	t-test	4.20**	4.41**	-1.08	0.74	12.41**	105.22**	1.07	
BSE 200	Coeff.	0.10	0.11	-0.06	0.82	0.11	0.88	0.07	0.01
	t-test	4.28**	4.96**	-1.15	0.99	12.58**	102.36**	0.91	
BSE 500	Coeff.	0.10	0.12	-0.06	0.12	0.11	0.88	0.07	0.01
	t-test	4.30**	5.55**	-1.10	1.02	12.74**	101.55**	0.91	
BSE Small Cap	Coeff.	0.07	0.28	-0.01	0.08	0.17	0.80	-0.03	0.08
	t-test	2.60**	13.93**	-0.22	3.68**	12.95**	69.12**	-0.31	
BSE Mid Cap	Coeff.	0.09	0.21	-0.05	0.07	0.14	0.83	-0.06	0.04
	t-test	3.74**	10.68**	-0.88	3.38**	14.10**	97.57**	-0.70	
CNX NIFTY	Coeff.	0.10	0.07	-0.06	0.01	0.10	0.89	0.11	0.002
	t-test	4.04**	3.36**	-0.97	0.32	12.15**	105.85**	0.17	
CNX 100	Coeff.	0.08	0.08	0.07	-0.02	0.11	0.88	0.24	0.004
	t-test	3.13**	3.76**	1.18	-1.13	12.21**	100.92**	**3.28****	
CNX 200	Coeff.	0.10	0.11	-0.07	0.02	0.11	0.88	0.08	0.01
	t-test	4.16**	4.80**	-1.23	0.91	12.64**	106.12**	1.03	
CNX 500	Coeff.	0.10	0.11	-0.07	0.02	0.11	0.88	0.07	0.01
	t-test	4.18**	5.19**	-1.33	0.96	12.68**	107.81**	0.93	
CNX Mid Cap	Coeff.	0.09	0.19	-0.06	0.06	0.13	0.84	-0.00	0.03
	t-test	3.67**	9.33**	-1.06	2.52*	13.38**	96.16**	-0.01	
CNX Nifty Junior	Coeff.	0.07	0.15	0.06	0.00	0.11	0.87	0.17	0.02
	t-test	2.51*	7.16**	11.46	0.06	12..36**	108.83**	1.76	

Note: **$p < 0.01$, * $p < 0.05$.

$$r_t = C + \rho\, r_{t-1} + \delta_1 Thu_t + e_t$$
$$e_t = u_t \sqrt{h_t} u_t \sim N(0,1)$$
$$h_t = \omega + \alpha \varepsilon^2_{t-1} + \beta h_{t-1} + \pi Thu_t \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

where, Thu_t, is the dummy variable for Thursday.

The results for the model used to capture the Thursday effect in the Indian stock market have been depicted in the Table 8. In the mean equation of the model, no such effect has been found for any of the indices taken in this study. Hence, the results fail to reject the null hypothesis $H_{02(c)}$ that there is no Thursday effect on returns of selected indices. The volatility has been found to be statistically significant at the 1% level of significance only for CNX 100.

(5) Friday Effect : The following equation is estimated to examine the Friday effect :

Table 9. Econometric Model at the Index Level to Check Friday Effect on Returns and Volatility

Indices	Statistics	Mean equation			Variance equation				
		C	AR	Fri_t	C	α	β	Fri_t	Ad. R^2
BSE Sensex	Coeff.	0.08	0.08	0.05	-0.01	0.10	0.89	0.20	0.01
	t-test	3.35**	3.58**	0.84	-0.83	12.09**	104.76**	2.97**	
BSE 100	Coeff.	0.08	0.09	0.06	-0.01	0.11	0.88	0.22	0.01
	t-test	3.15**	4.34**	1.02	-0.80	12.36**	100.31**	3.22**	
BSE 200	Coeff.	0.08	0.11	0.06	-0.01	0.11	0.87	0.20	0.01
	t-test	3.20**	4.91**	1.01	-0.56	12.51**	98.14**	3.07**	
BSE 500	Coeff.	0.08	0.12	0.05	-0.01	0.11	0.87	0.20	0.01
	t-test	3.30**	5.49**	0.90	-0.48	12.68**	97.72**	3.02**	
BSE Small Cap	Coeff.	0.08	0.27	-0.08	0.02	0.17	0.80	0.28	0.08
	t-test	3.17**	13.44**	-1.36	0.85	13.08**	68.19**	3.01**	
BSE Mid Cap	Coeff.	0.07	0.21	0.04	0.00	0.15	0.83	0.25	0.04
	t-test	3.06**	10.48**	0.80	0.18	14.16**	97.13	2.96**	
CNX NIFTY	Coeff.	0.08	0.07	0.05	-0.01	0.10	0.89	0.19	0.00
	t-test	3.11**	3.33**	0.90	-0.49	1207**	100.36**	2.64**	
CNX 100	Coeff.	0.09	0.08	-0.01	0.05	0.10	0.89	-0.10	0.00
	t-test	3.65**	3.91**	-0.23	3.46**	12.37**	107.73**	-1.43	
CNX 200	Coeff.	0.07	0.10	0.06	-0.00	0.11	0.88	0.19	0.01
	t-test	2.96**	4.77**	1.14	-0.33	12.56**	101.78**	2.83**	
CNX 500	Coeff.	0.07	0.11	0.07	-0.01	0.11	0.88	0.19	0.01
	t-test	2.93**	5.16**	1.22	-0.44	12.60**	103.52**	2.86**	
CNX Mid Cap	Coeff.	0.07	0.19	0.07	0.00	0.14	0.84	0.25	0.03
	t-test	2.66**	9.20**	1.31	0.26	13.25**	94.33**	2.81**	
CNX Nifty Junior	Coeff.	0.05	0.15	0.14	0.00	0.12	0.87	0.20	0.02
	t-test	2.04*	7.21**	**2.36***	0.02	12.46**	104.89**	2.06*	

Note: **$p < 0.01$, *$p < 0.05$.

$$r_t = C + \rho\, r_{t-1} + \delta_1 Fri_t + e_t$$
$$e_t = u_t \sqrt{h_t} u_t \sim N(0,1)$$
$$h_t = \omega + \alpha \varepsilon^2_{t-1} + \beta h_{t-1} + \pi Fri_t \quad \text{.......................................(5)}$$

Here, Fri_t is the dummy variable for Friday.

The Table 9 reveals the outcome of $AR(1) - GARCH(1,1)$ model run to check the Friday effect on the returns. The results show that the Friday effect is only observed for CNX Nifty Junior. Coefficient of Friday dummy is statistically significant at the 5 % significance level. The results reject the null hypothesis $H_{02(d)}$ that there is no Friday effect on returns of CNX Nifty Junior. No such effect is found in any of the other BSE and NSE indices taken in this study.

The results of variance equation show that volatility in index returns is statistically significant at the 5% significance level for CNX Nifty and at the 1% significance level for rest of the indices except, CNX 100. Volatility for CNX 100 is not statistically significant. Overall, the results show that volatility is high on Friday than the other trading days of the week in the Indian stock market. This finding supports the macroeconomic news release hypothesis.

Conclusion and Implications

This study examines the existence of day-of-the-week effect in the Indian stock market. The study does not find such an effect on most of the indices taken for this study. The results show the mean returns of only one index, Nifty Junior, are statistically significant for the *t*-test. However, no such difference is observed in any of the index (BSE & NSE) in ANOVA. To confirm the findings of *t*-test and ANOVA, an econometric model, AR (1)-GARCH (1, 1) was used. In contrast to the findings on the other indices, returns on Monday for BSE Small Cap are statistically significant. It has also been observed that volatility on Monday for returns on BSE Small Cap are statistically significant. Returns on Tuesday for BSE Small Cap and BSE Mid Cap are negative and statistically significant. Returns on these two indices are also found to be negatively volatile on Tuesday. Investors should avoid their investment on this index on Tuesday. Wednesday effect is only observed in case of Nifty Junior, but there is no volatility captured on Wednesday for Nifty Junior. Returns on Nifty Junior are also positive and statistically significant on Friday, but there is no volatility captured for returns on Nifty Junior on Friday too.

This study supports the findings of Amarnani and Vaidya (2014) regarding the negative returns on Monday for NSE NIFTY but does not support the positive returns on Monday for BSE SENSEX as it has observed negative returns on Monday for BSE SENSEX.

The findings of this study support the findings of Osborne (1962), Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishok and Levi (1982), Keim and Stambaugh (1984), Rogalski (1984), Jaffe and Westerfield (1985), and Jacobs and Levy (1988) by observing day of the week effect in the Indian stock market. The present study found positive returns on Friday for the Indian stock market. French (1980) addressed this as weekend effect and pointed out that the returns on Fridays were positive, while the returns on Monday were abnormally negative.

According to the efficient market hypothesis, investors cannot gain abnormal returns on their investments since all information is reflected in stock prices. We have seen in the findings of some of the recent studies that there is no existence of day of the week effect in the Indian stock market. This study also supports the findings of such previous studies for most of the indices, which is a sign of an efficient market. The findings of this study will help the investors to prepare their investment strategy for indices where day-of-the-week effect exists, either in negative or in positive form.

Limitations of the Study and Scope for Further Research

Since the economical environment does not support the Halloween Effect, this effect could not be tested in this study. Though, there are many other indices in the NSE and BSE, this study only includes five indices from both the stock exchanges. Day of the week effect could have been tested for pre and post sub-prime crises period since this study covers a period of 10 years (2005-2014), considering the upper limit of the length of the paper, it could not have been accomplished.

This research has been carried out with the selected indices of NSE and BSE, hence, infers only about day of the week effect on the returns of these indices. Further studies can be carried out including remaining indices of NSE and BSE and all sector indices to check such an effect.

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