International Journal of Accounting and Finance

ISSN online: 1752-8232 - ISSN print: 1752-8224
https://www.inderscience.com/ijaf

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DOI: 10.1504/IJAF.2023.10060038

Article History:

Received:	16 May 2021
Last revised:	04 November 2022
Accepted:	12 January 2023
Published online:	26 October 2023

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Abstract: The objective of the present study is to examine the day-of-the week effects in the Indian stock market. For analysis, we selected the BSE Ltd and NSE benchmark indices namely S&P BSE SENSEX and NSE Nifty 50 in this research. The sample included from 1st April 2011 to 31st March 2021, which consists of ten years. The findings reveal that the values of coefficients of Wednesday are positively significant for S&P BSE SENSEX and NSE Nifty 50 Indices. The results from the study suggest that it would be beneficial for the investors to sell shares on Wednesdays and buy shares on other trading days. The results from the present study would be beneficial to individual investors, institutional investors, investment brokers, and administrators in companies.

Keywords: calendar anomalies; day of the week effect; ADF test; ARIMA; GARCH.

Reference to this paper should be made as follows: Elangovan, R., Gnanasekar, F. and Parayitam, S. (2023) 'Day of the week effect in the Indian stock market', *Int. J. Accounting and Finance*, Vol. 11, No. 3, pp.181–201.

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1 Introduction

One of the exhaustively researched areas in the field of finance and economics is the efficient market hypothesis (EMH) which claims that a market is considered efficient where stock prices always fully reflect the available information (Fama, 1970). The researchers for over the last five decades have explored the EMH by three forms, viz., weak form, semi-strong form, and strong form. Previous researchers have eloquently documented that EMH was challenged by three groups of anomalies, viz., calendar anomalies (seasonal), technical anomalies, and fundamental anomalies (Srinivasan and Kalaivani, 2013). Following this, calendar anomalies have remained one of the fascinating topics of interest in the field of finance, and several researchers in the world have explored this dimension. These anomalies, which affect stock returns, are the day-of-the-week effect, weekly effect, weekend effect, month-of-the year effect, semi-month effect, turn-of-the month effect, holiday effect, Diwali effect, Ramadan effect, January effect, Halloween effect, etc. (Agrawal and Tandon, 1994; Barone, 1990; Compton et al., 2013; Floros, 2008; Haroon and Shah, 2013; Lakonishok and Smidt, 1988; Patel and Sewell, 2015). It is interesting to note that while some of the earlier studies did not support the presence of seasonality (Cheung and Coutts, 1999; Zinbarg and Harrington, 1964), some studies provided strong support for the seasonality (e.g., Easterday et al., 2009).

The aim of this paper is to test the presence or absence of the day-of-the-week effect in the Indian stock market. The evidence of stock market anomalies challenges the prediction of EMH at least in its weak form because predictable movements in asset prices enable the investors to generate abnormal returns (Aly et al., 2004). The intuitive logic behind the anomalies is that they generate inefficient flow of information in financial markets, thus violating the underlying assumptions of EMH. The fact remains that stock markets depend upon sentiments (calendar anomalies) which are inherent and inescapable.

The previous studies conducted in stock market in India showed mixed results. While some studies reported significant week-end effects (Mallick and Debasish, 2013; Paital and Panda, 2018; Patjoshi and Nandini, 2020; Rastogi et al., 2011; Singhal and Bahure, 2009), only one study did not show week-end effects (Arumugam and Soundararajan, 2013), some studies showed positive returns on Mondays (Chia and Liew, 2010; Raj and Kumari, 2006), and several studies did not find day-of-the-week effects (Bhattacharya et al., 2012; Desai et al., 2011; Kothari et al., 2017; Nageswari and Babu, 2011; Nageswari and Selvam, 2011; Pathak, 2013; Soni and Joshi, 2018; Uthra, 2018). These studies reveal that seasonality is not a conclusive evidence in Indian stock market. Amidst the mixed evidences, we attempt to report the current state of market efficiency. In addition, we attempt to explain the probable reasons for existence of or non-existence of seasonality. Instead of replication of studies, the rationale behind this research is to explain the causes behind the seasonality.

We also reviewed researches done in the other parts of the world. Some studies reported that the day of the week effect is present in both return and volatility equations in several developed countries, viz., Canada, Germany, and Japan (Kiymaz and Berument, 2003), Fridays are profitable in Shanghai and Shenzhen Stock Exchanges (Gao and Kling, 2005), largest mean weekday returns occur on Monday for 15 companies in Australia (Liu and Li, 2010). Some studies provided evidence on the twist-of-the-Monday effect in Indonesia, Malaysia, Singapore, Thailand, and Philippines (Lim and Chia, 2010), and the presence of the day-of-the week effect in both volatility and returns equations in Johannesburg Stock Exchange (JSE) Indices for the period March 1995–2016 (Monday and Friday) (Du Toit et al., 2018). Some studies reported 'no evidence' to support any daily seasonal patterns in the Egyptian stock market (Aly et al., 2004), and in the Japan Stock Exchange (Mbululu and Chipeta, 2012), and in Muscat securities market (Al-Jafari, 2012). Therefore, the results are mixed and inconsistent.

2 Brief history of calendar effects

It was Fields (1931) who identified the possibility of calendar effects though his four-page article was mainly unempirical, but it was after four decades Cross (1973) started empirically observing the Dow Jones Index which measures the stock performance of 30 large companies listed in stock exchange. Statistical testing of calendar effects started with the seminal work of French (1980) who postulated two alternative models leading to two different hypotheses:

1 calendar time hypothesis

2 trading time hypothesis.

According to calendar time hypothesis, it is postulated that the expected return for Monday is three times the expected return for the other days of the week. On the other hand, the trading time hypothesis postulates that expected returns for each day of the week will be equal and there would not be any differences. Surprisingly, it was found that from 1953 to 1977, the daily returns to the Standard and Poor's (S&P) composite portfolio did not support both the hypotheses. When the analysis was done using t-test and Bayesian approaches, it was revealed that the average return for Mondays was significantly negative whereas average returns of the other four days was positive, and this gave rise to further analysis. Subsequent researchers analysed

1 Monday effect

2 non-trading week-end effect (Rogalski, 1984) and found that the non-trading week-end effect was significant and Monday effect was not.

The subsequent researchers (Jaffe and Westerfield, 1985; Condoyanni et al., 1987) followed the same approach and analysed stock markets in various countries, viz., Australia, Canada, Singapore, Japan, and some European countries, and found that on Monday's the average returns were significantly negative.

The testing has undergone revolutionary change with the introduction of more powerful econometric models such as GARCH (Sullivan et al., 2001) as the earlier simple linear regression (SLR) testing had inherent problems of non-normality and conditional heteroskedasticity of residuals and autocorrelation (Connolly, 1989). The researchers started analysing the data using linear regression on dummies, generalised autoregressive conditional heteroskedasticity (GARCH), bootstrap approach, and Bayesian approach.

We present a summary of the previous studies conducted in India, in Table 1. We also present a summary of the day-of-the week effect conducted in stock markets in various countries in Table 2.

Table 1 A summary of day of the week effect in the Indian context

Year	*Study*	*Sample*	*Result*
1996	Poshakwale	Bombay Stock Exchange National Index; 2nd January 1987 to 31st October 1994	The day of the week effect observed on the BSE
2003	Bhattacharya et al.	BSE 100 Index from January 1991 to September 2000	Significant positive effect on non-reporting Friday as also on non-reporting Thursday
2004	Gupta and Aggarwal	National Stock Exchange of India's Nifty Index	The day of week effect is very well prevalent in India and Wednesday is the day when the returns were found to be significantly different from others

Table 1 A summary of day of the week effect in the Indian context (continued)

Year	*Study*	*Sample*	*Result*
2004	Sarma	SENSEX, NATEX, and BSE200; 1st 1996 to August 10th 2002	Consistent abnormal returns through a trading strategy of buying on Mondays and selling on Fridays
2006	Raj and Kumari	National Stock Exchange (NSE) and Bombay Stock Exchange (BSE): 1987–1998	Monday returns are positive while Tuesday returns are negative
2009	Singhal and Bahure	BSE SENSEX, BSE 200 and the S&P Nifty; April 2003 to April 2008	Evidencing the existence of this 'weekend effect'
2010	Chia and Liew	Bombay) Stock Exchange (BSE) over the pre 9/11 and post·9/11 sub-periods	Existence of significant positive Monday effect and negative Friday effect
2011	Rastogi et al.	S&P CNX Nifty Index as well as S&P CNX Nifty futures from 1st January 2003 to 31st December 2008	Weekend effect during the non-trading period in the spot index market, while, there is no day of the week effect in the index futures market
2011	Desai et al.	Major indices of National Stock Exchange (NSE) and Bombay Stock Exchange (BSE): January 2000 to October 2010	The day of the week effect is found to be absent in their study
2011	Nageswari and Selvam	BSE SENSEX Index; April 2000 to 31st March 2010	Day of the week effect did not appear to exist in the Indian stock market
2011	Nageswari and Babu	NSE CNS Nifty Index; 1st April 2002 to 31st March 2010	The day of the week pattern did not appear to exist in the Indian stock market
2012	Deepak and Viswanath	NSE Nifty Index; 1990 to 2011	The day-of-the-week effect was observed in the NSE Nifty returns
2012	Bhattacharya et al.	National Stock Exchange of India's (NSE Nifty); 1 April 2005 to 31 March 2010	Non-existence of the day effect
2013	Mallick and Debasish	National Stock Exchange (NSE); 1st January 2007 to 31st December 2011	Evidenced day of the week effect mostly either on Tuesday, Wednesday or Thursday
2013	Pathak	S&P CNX Nifty (NSE); 1st April 2007 to 31st March 2012	Non-existence of the day effect
2013	Arumugam and Soundararajan	BSE Index and companies	There is no strong evidence for weekend effect in the BSE Index
2014	Khanna	Indian stock market for the period from 1 January 2006 up to 31 December 2010	Exhibited that the average returns of all the trading days are not identical, which confirms the presence of day-of-the-week anomaly

Table 1 A summary of day of the week effect in the Indian context (continued)

Year	*Study*	*Sample*	*Result*
2014	Srinivasan and Kalaivani	NSE-Nifty Index and BSE-SENSEX Index; 1st July 1997 to 29th June 2012	Reveals positive Monday and Wednesday effects in the NSE-Nifty and BSE-SENSEX market returns
2014	Mitra and Khan	National Stock Exchange Nifty 50 Index; January 2001 to December 2012	Does not depict such day of the week effects
2015	Aziz and Ansari	BSE SENSEX Index and NSE Nifty Index; 1990 to 2013	The traditional Monday effect is non-existent
2015	Lodha and Soral	Bombay Stock Exchange (BSE) major indices	Monday has been emerged to be significant for all indices except BSE power and realty
2016	Mitra	The BSE SENSEX and the NSE Nifty Index; January 2000 to December 2015	There is no existence of day-of-the-week effect on the stock return of SENSEX and Nifty Indices
2016	Gnanasekar and Rajesh	National Stock Exchange CNX Nifty Index	Existence of the day of the week effect (Monday)
2017	Kumar and Jawa	Nifty 50 data from its inception in January 1995 to December 2015	revealed the existence of calendar effects in India in form of a significant Wednesday effect
2017	Bhuva and Thankachan	Nifty and stocks of auto mobile sector	The day of the week the effect is present in both return of auto sector and volatility of the sector
2018	Uthra	BSE Auto Index; 2002 to 2016	There is no existence of day of the week effect
2018	Arora	National Stock Exchange Nifty 50 Index	No day of the week effect is evident
2018	Paital and Panda	National Stock Exchange Nifty 50, Nifty Midcap 50 and Nifty Small Cap 50 Indices; 1st April 2005 to 29th June 2018	Strong evidence of a positive weekend effect as well as a negative Tuesday effect
2018	Soni and Joshi	National Stock Exchange Index; January 2010 to December 2017	Day of the week effect did not appear in the Indian stock market
2017	Kothari et al.	Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) Indices	Does not find the day of the week effect on most of the indices
2020	Patjoshi and Nandini	Four major indices of the Bombay Stock Exchange; 1st January 2000 to 31st December 2018	Days of the week are statistically significant, and Fridays recorded highest returns

Table 2 Summary of the day of the week effect in the non-Indian context

Year	*Study*	*Sample*	*Result*
2003	Kiymaz and Berument	TSE-Composite (Canada), DAX (Germany), Nikkei-225 (Japan), FT-100 (UK), and NYSE-Composite (NYSE) indexes from 1 January 1988 to 28 June 2002	The day of the week effect is present in both return and volatility equations
2004	Aly et al.	Egyptian stock market the Capital Market Authority Index (CMA)	No evidence was uncovered to support any daily seasonal patterns in the Egyptian stock market
2005	Gao and Kling	Market Index of the Shanghai and Shenzhen Stock Exchanges	Fridays are profitable
2005	Bahadur and Joshi	Nepal Stock Exchange Index from 1 February 1995 to 31 December 2004	Evidence of day-of-the-week anomaly
2009	Rahman	DSE Indices such as DSE all share prices Index (DSI), DSE General Index (DGEN) and DSE 20 Index DSE 20): 4 September 2005–8 October 2008	A significant day of the week effect present in DSE
2010	Silva	PSI-Geral (or BVL-Geral) and the PSI20-TR Index; May 1989 ending on 31 December 2008	The Monday effect could not be found in the Portuguese stock market
2010	Liu and Li	Top 50 Australian companies across different industry sectors; January 2001 through June 2010	Largest mean weekday returns occur on Monday for 15 companies
2010	Lim and Chia	Indonesia, Malaysia, Singapore, Thailand and the Philippines stock markets from 10 June 2002 through 21 August 2009	Evidence on the twist-of-the-Monday effect
2010	Ullah et al.	Pakistani stock market; 2 June 2003 to 2 June 2008	The day of the week effect has no significant influence on the stock returns
2012	Swami	Major daily index of India, Pakistan, Bangladesh, Srilanka and Nepal	The day of the week effect, have been found to exist in Sri Lanka and Bangladesh
2011	Georgantopoulos et al.	Emerging Balkan stock markets (Romania, Bulgaria, Croatia and Turkey) and Greece; January 2000 till July 2008	Evidence for the existence of three calendar effects (day of the week, in both mean and volatility equations
2012	Mbululu and Chipeta	Economic stock market sector indices of the JSE	No evidence of the day-of-the-week effect
2012	Patel et al.	Asian countries stock exchanges namely: India, Hong Kong, Japan and China	There is no evidence of the 'day of the week effect' in the markets
2012	Al-Jafari	Muscat securities market; 1 December 2005 until 23 November 2011	Evidence of no presence of the day-of-the-week effect

Table 2 Summary of the day of the week effect in the non-Indian context (continued)

Year	*Study*	*Sample*	*Result*
2013	Kuria and Riro	Major indices of Nairobi Securities Exchange (NSE)	Evidence about the presence of the seasonal effect in the NSE
2013	Angelovska	Major Macedonian Stock Exchange Index, the MBI10 Index, in the period from 4 January 2005 to 31 December 2009	Found evidence about the existence of a day of the week effect on Thursday
2013	Lari et al.	Five stock markets in Southeast of Asia (Indonesia, Malaysia, Philippine, Singapore and Thailand); 31 December 2007 to 31 December 2011	The presence of the day of the week effect only in Indonesia other do not provide the existence of the daily effect
2014	Kohli	Sweet crude oil is collected for the period 30 March 1983 through 12 October 2012	Indicated the presence of the day-of-the-week effect in crude oil markets and significantly positive for Friday
2015	Gouider et al.	Tunisian Stock Market Index TUNINDEX; 2006–2010 and 2011–2013)	The effect Monday has disappeared because Monday and Tuesday returns are not significant
2017	Zhang et al.	Main indices in 28 markets from 25 countries over the world	The Monday anomalies are prominent in different countries
2018	Du Toit et al.	Johannesburg Stock Exchange (JSE) Indices for the period March 1995–2016	Day-of-the week effect is present both volatility and returns equations (Monday and Friday)
2020	Gayaker et al.	Borsa Istanbul 100 Indices (formerly known as the Istanbul Stock Exchange-ISE); 2 January 1990 to 12 October 2017	The day of the week effect decreases
2020	Adaramola and Adekanmbi	All Share Index returns of the Nigerian Stock Exchange between 2000 and 2017	Three (MON, TUE, FRI) day of the week effects found

2.1 Rationale for the study

As can be seen in Tables 1 and 2, several studies were conducted that analysed the day-of-the week returns. The literature review reveals that the calendar effects are inconsistent and thus challenging the EMH. If we follow the EMH that flow of information is continuous and prices reflect all information, then Monday's returns are expected to be three times higher than the other weekday returns. This is because there are three calendar days between market closing on Friday and the market closing on Monday. However, assuming that information flow is disrupted during the weekends, it is expected that Monday's returns would be higher when compared to the rest of the days. If

we closely look at Tables 1 and 2, we can see that both the hypotheses did not get support as the results were mixed.

Despite conflicting results by different researchers in the field of finance and economics, the study of calendar effects is relevant for the financial managers, investment brokers, investors, and all stakeholders interested in choosing their profitable investment strategies.

2.2 Objectives of the study

The overall objective of the study is to examine the existence of the day of the week effect in Indian stock markets. The following are specific objectives they are

1 to know the whether return series of the indices are stationary or not

2 to identify the descriptive statistics for S&P BSE SENSEX and NSE Nifty 50 Indices for the day of the week

3 to identify whether markets follow a normal distribution.

3 Hypotheses

H01 There is no stationarity in the return series of sample indices.

H02 The daily mean returns are statistically equal across the trading days.

H03 Return series is normally distributed.

4 Methodology

4.1 Sample

In India, the two leading recognised stock exchanges, viz., the BSE Ltd and NSE, play a vital role in the growth of the Indian economy. Hence, most of the researchers consider these two stock exchanges' benchmark indices namely S&P BSE SENSEX and NSE Nifty 50. The sample included from 1st April 2011 to 31st March 2021, which consists of ten years.

4.2 Data collection

The present empirical study was mainly based on the secondary data collected from the official websites of Bombay Stock Exchange (i.e., http://www.bseindia.com) and National Stock Exchange (i.e., http://www.nseindia.com). The data collected for this study included: 'daily open', 'high', 'low' and 'closing prices' of benchmark indices of the Indian stock market. The daily returns are calculated for the entire original average or closing index prices of both indices by using this formula:

$$r_t = \ln\left(p_t / p_{t-1}\right) * 100$$

where r_t is the return at the time t, ln represents natural log, p_t and p_{t-1} are closing prices at time t and $t-1$ respectively.

4.3 Tools used for the study

The tools used in this study are:

1 Stationarity test (the test value of intercept, intercept and trend and none test statistics are less than their critical values at 1%, 5% and 10% levels of significance then considered as the stationary).

2 Regression equation (for examining the day of the week effect the researchers consider only regular trading day, viz., Monday, Tuesday, Wednesday, Thursday and Friday. The special trading days, i.e., Saturday and Sunday have been excluded in this study (as stock markets are not operating on these days). The following regression equation used to find the day of the week effect.

$$Y_t = \alpha_3 + \alpha_1 DMon + \alpha_2 DTue + \alpha_4 DThu + \alpha_5 DFri + \varepsilon_1$$

where α_3 is a constant which is the average mean return for Wednesday trading day, and coefficients α_1 to α_5 denote the average differences between the return from Monday to Friday (normal trading days) except on Wednesdays. If the value of the coefficient of α_1 to α_5 is zero, then the return for each day is identical and there is no day of the week effect exists, and ε_1 is a white noise error term.

3 The ARIMA model used to remove the persistence of serial correlation, and

4 The GARCH model used to remove the heteroskedasticity effect.

5 Data analysis and interpretation

5.1 Stationarity analysis

The analysis of stationarity of data is essential for the time series data. To test stationarity, it is customary for the researchers to use augmented Dickey-Fuller (ADF) test. The ADF test is a negative number and the higher the negative number is the stronger is the rejection of null hypothesis that there is unit root. If any data in non-stationarity nature, then the outcome of the analysis result becomes spurious. Therefore, we analysed the return series of S&P BSE SENSEX and NSE Nifty 50 Indices.

The results of ADF analysis S&P BSE SENSEX and NSE Nifty 50 Indices return series were presented in Table 3.

Table 3 reveals the result of the ADF test for the return series of S&P BSE SENSEX and NSE Nifty 50 Indices. The intercept of ADF test statistics of S&P BSE SENSEX (–38.2530) and NSE Nifty 50 (–39.5224) is less than their critical values of 1%, 5% and 10% levels of significance respectively. The intercept and trend equation of ADF test statistics of S&P BSE SENSEX (–38.2600) and NSE Nifty 50 (–39.5269) are less than their critical values of 1%, 5% and 10% levels of significance respectively. The ADF test statistics of S&P BSE SENSEX (–38.2065) [none in the equation] and NSE Nifty 50 (–39.4774) [none in the equation] are less than their critical values of 1%, 5% and 10%

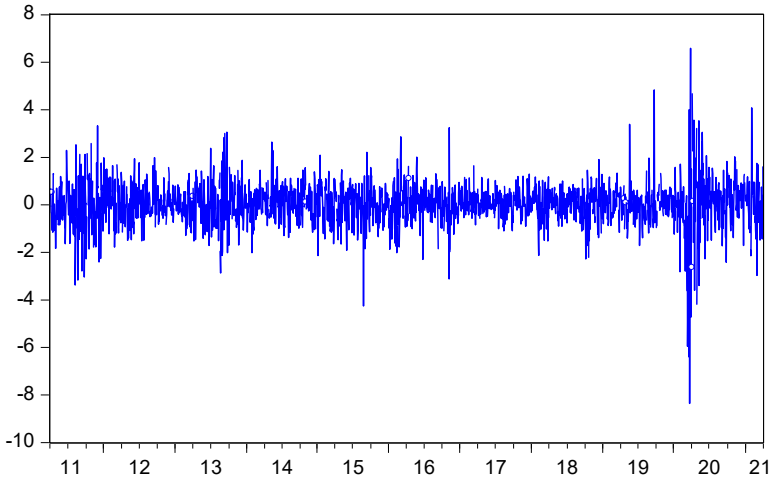
levels of significance respectively. Therefore, it could be interpreted that the entire three variants equation of the ADF test has confirmed the stationarity of the return series of S&P BSE SENSEX and NSE Nifty 50 Indices. Hence, H01 (there is no stationarity in the return series of sample indices) is rejected.

Table 3 ADF test statistic of S&P BSE SENSEX and NSE Nifty 50 Indices return series

Index	*Type*	*t-value*	*Test critical values*		
			1%	*5%*	*10%*
S&P BSE SENSEX	Intercept	–38.2530	–3.4328	–2.8625	–2.5673
	Intercept and trend	–38.2600	–3.9618	–3.4116	–3.1277
	None	–38.2065	–2.5659	–1.9410	–1.6166
NSE Nifty 50	Intercept	–39.5224	–3.4328	–2.8625	–2.5673
	Intercept and trend	–39.5269	–3.9618	–3.4116	–3.1277
	None	–39.4774	–2.5659	–1.9410	–1.6166

Source: Compiled from EViews7

Figure 1 S&P BSE SENSEX return (see online version for colours)

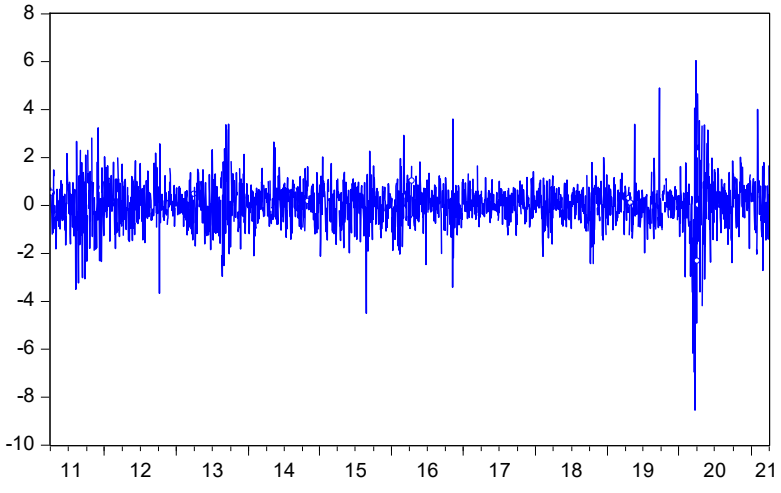


Source: Compiled from Eviews7

As can be seen in Figures 1 and 2, the indices are fluctuating from high to low at different time periods and returning to their respective means. During the year 2020 the graph line of both indices shows high volatility because if the impact COVID-19 global pandemic. It understood that both indices have constant mean returns over the period and the mean values lie on 0. These results indicate that both indices are stationarity in nature.

Day-wise descriptive statistics of S&P BSE SENSEX and NSE Nifty 50 Indices return series are presented in Table 4.

Figure 2 NSE Nifty 50 return (see online version for colours)



Source: Compiled from Eviews7

Table 4 Day wise descriptive statistics of S&P BSE SENSEX and NSE Nifty 50 Indices return series

Index	*D. statics*	*Monday*	*Tuesday*	*Wed.*	*Thu.*	*Friday*	*All*
S&P BSE SENSEX	Mean	0.007	0.046	0.067	0.038	0.032	0.038
	Maximum	4.829	4.670	3.536	6.586	4.004	6.586
	Minimum	–8.355	–3.600	–4.162	–6.395	–3.596	–8.355
	Std. dev.	1.024	0.806	0.778	0.950	0.897	0.894
	Skewness	–1.510	0.261	–0.070	–0.291	–0.180	–0.538
	Kurtosis	14.312	7.483	6.194	15.309	5.800	11.669
	Jarque-Bera	2,804*	420*	212*	3,100*	162*	7,835*
	Probability	0.000	0.000	0.000	0.000	0.000	0.000
	Observations	491	496	499	490	488	2,464
NSE Nifty 50	Mean	0.006	0.056	*0.065*	0.032	0.029	0.038
	Maximum	4.902	4.657	3.362	6.042	4.060	6.042
	Minimum	–8.546	–3.610	–4.131	–6.953	–3.670	–8.546
	Std. dev.	1.058	0.815	0.796	0.972	0.935	0.919
	Skewness	–1.477	0.300	–0.112	–0.536	–0.273	–0.617
	Kurtosis	13.909	7.062	5.949	15.033	5.870	11.434
	Jarque-Bera	2,613*	348*	181*	2,979*	173*	7,459*
	Probability	0.000	0.000	0.000	0.000	0.000	0.000
	Observations	491	496	499	490	488	2,464

Note: *indicate that the level of significance at the 1% level.

Source: Compiled from EViews7

Table 4 shows the day-wise descriptive statistics of the S&P BSE SENSEX and NSE Nifty 50 Indices. Both indices' maximum daily average and mean return occurred on Wednesday trading day. On the other hand, the lowest mean returns occurred on Monday trading day for both indices. This indicates that among the trading days of the week, the mean returns for all the trading days were different return distributions. Therefore, H02 (the daily mean returns is statistically equal across the trading days) is rejected. The standard deviation of returns series maximum occurred on Monday for both indices. It can be interpreted that the utmost volatility is found on Monday alone. For intraday traders, Monday is an appropriate day for intraday trading. The value of skewness returns distribution is found to be negative for all days of the week except Tuesday. The results reveal that the daily trading returns are asymmetrical distributions. The values of kurtosis are greater than three for all trading days of the week for both the indices, representing that distribution of returns of all the trading days of the week more skewed (peaked) and is leptokurtic. The coefficient value of the Jarque-Bera test statistic is significant at a 1% level for all trading days of S&P BSE SENSEX and NSE Nifty 50 Indices. The results provide strong evidence that the distribution of the daily returns was asymmetric, thus confirming that the distribution of the daily returns is not normally distributed. Thus, H03 (return series is normally distributed) is rejected.

5.2 OLS dummy variable regression equation model

The descriptive statistics from the study reveal that there is no strong evidence of the day of the week effect for all the indices. Therefore, we wanted to identify the day of the week effect by using the ordinary linear regression (OLS) dummy variable regression equation for Monday, Tuesday, Thursday, and Friday. The day-wise descriptive statistics show that the maximum mean return occurred on Wednesday for both indices. Hence, the daily mean return of Wednesday has taken as yardstick day for comparing returns of other trading days for both indices. As a result, the mean return of Wednesday will be the constant term for the OLS regression equation.

Table 5 The results of the OLS dummy variable regression model of the day of the week effect for S&P BSE SENSEX and NSE Nifty 50 Indices

Variables	*S&P BSE SENSEX*	*NSE Nifty 50*
Monday	–0.059 (–1.045)	–0.059 (–1.014)
Tuesday	–0.021 (–0.366)	–0.009 (*–0.151*)
Wednesday (C)	0.067 (1.662)	0.065 (1.574)
Thursday	–0.029 (–0.503)	–0.032 (–0.555)
Friday	–0.034 (–0.600)	–0.036 (–0.615)
Adj. R^2	–0.001158	–0.001100
F-stat.	0.287687	0.323357
D-W stat.	1.490879	1.552434
AIC	2.617865	2.672718
SBC	2.629654	2.684507

Source: Compiled from EViews7

The results of the OLS dummy variable regression model of the day of the week effect for S&P BSE SENSEX and NSE Nifty 50 Indices are presented in Table 5.

As can be seen in Table 5, the coefficient values of Monday, Tuesday, Thursday and Friday have an insignificant level for both indices. The coefficient values of Wednesday are positive for the S&P BSE SENSEX Index and NSE Nifty 50 but not significant. The adjusted R-squared values are negative for both indices. Moreover, the F-statistic values are very low with the p-value. Hence, it is evident that the OLS dummy variable regression model is spurious, i.e., the OLS dummy variable regression model does not indicate the day of the week effect. Besides, the Durbin-Watson statistics values for both indices are less than the value of two, which indicates the existence of serial correlation in this model. To confirm the serial correlation, we applied the Breusch-Godfrey LM test to the OLS dummy variable regression results.

The results of LM-test statistics before and after ARIMA modelling of the day of the week effect in S&P BSE SENSEX and NSE Nifty 50 Indices are presented in Table 6.

As can be seen in Table 6, the LM test values before ARIMA for both indices are very high with a 0.000 p-value, indicating strong evidence for the existence of serial correlation. After confirmation of serial correlation in the time series data, it is necessary to remove by appropriate ARIMA modelling because of spurious OLS results, i.e., the value of variance is not minimum and adjusted R-squared will be overvalued as a better fit model rather than the actual value. As per the Box-Jenkins methodology, the appropriate ARIMA terms are added to the equation for both Indices to remove the persistence of serial correlation. After the inclusion of ARIMA terms in the OLS dummy variable regression equation, the Breusch-Godfrey LM test has decreased, and the p-values are increased dramatically. That means after inclusion of the appropriate AR and MA terms in the equation serial correlation has been removed.

The results of the ARCH-LM test of heteroskedasticity effect before and after GARCH model are presented in Table 7.

Table 6 The results of LM-test statistics before and after ARIMA modelling

Indices	*Before ARIMA*		*After ARIMA*			
	LM-test	*P-value*	*AR terms*	*MA terms*	*LM-test*	*P-value*
S&P BSE SENSEX	163.20	0.000	1	1	0.381	0.827
NSE Nifty 50	123.99	0.000	1	1	0.549	0.760

Notes: ARIMA modelling of the day of the week effect in S&P BSE SENSEX and NSE Nifty 50 Indices

Source: Compiled from EViews7

Table 7 The results of ARCH-LM test of heteroskedasticity effect before and after GARCH model

Indices	*Before GARCH*		*After GARCH*			
	ARCH-test	*P-value*	*ARCH terms*	*GARCH terms*	*ARCH-test*	*P-value*
S&P BSE SENSEX	253.543	0.000	2	0	0.0119	0.9133
NSE Nifty 50	273.421	0.000	2	0	0.0078	0.9293

Source: Compiled from EViews7

Table 8 The results of GARCH model in S&P BSE SENSEX and NSE Nifty 50 Indices for day-of-the-week effect

Variables	*S&P BSE SENSEX*	*NSE Nifty 50*
Monday	–0.048 (–1.051)	–0.047 (–0.996)
Tuesday	–0.031 (–0.769)	–0.020 (–0.472)
Wednesday (C)	0.093 (2.867)*	*0.089 (2.709)**
Thursday	–0.040 (–1.094)	–0.047 (–1.190)
Friday	–0.025 (–0.594)	–0.025 (–0.575)
Adj. R^2	0.055577	0.039193
D-W stat.	2.157881	2.152132
AIC	2.287911	2.373897
SBC	2.311497	2.397482

Note: *indicate that the level of significance at the 1% level.

Source: Compiled from EViews7

To test the effect of heteroskedasticity we conducted the ARCH test. The regression results of ARIMA terms having heteroskedasticity effect as the ARCH test value of obs. * R-squared high value with 0.000 p-values. After confirmation of the heteroskedasticity effect, in order to remove the heteroskedasticity effect we included proper GARCH model in the regression equation. Again, when the ARCH test was applied, and the results, shown in the last two-columns of Table 7, reveal that the test values of ARCH obs. * R-squared reduced and the p-values are increased. That means the effect of heteroskedasticity has been removed after the inclusion of the GARCH model.

The results of the GARCH model in S&P BSE SENSEX and NSE Nifty 50 Indices for day-of-the-week effect model are presented in Table 8.

It contains the summarised estimated results namely the coefficients value of different trading days, z-statistic value, i.e., shown in parentheses, adjusted R-squared, Akaike info criterion (AIC) and Schwarz criterion (SBC). The coefficients values of Monday, Tuesday, Thursday and Friday have a negatively insignificant regression coefficients for both indices. The regression coefficients for Wednesday are positively significant for S&P BSE SENSEX [(β = 0.093 (2.867)*] and NSE Nifty 50 Indices [(β = 0.089 (2.709)*]. It is very interesting to note that for both indices the day of the week effect is significant only for Wednesday. Therefore, the results document that the day of the week effect as the 'Wednesday effect'.

6 Results and discussion

The findings of the study reveal that intercept, intercept and trend and none equation of ADF test are less than their critical values of 1%, 5% and 10% levels of significance respectively. Therefore, it could be interpreted that the all three variants equation of the ADF test confirms the stationarity of the return series of S&P BSE SENSEX and NSE Nifty 50 Indices.

To sum up the results:

1 The maximum average or mean return occurred on Wednesday for both indices, and the lowest returns occurred on Monday for both indices. These results also indicate that among the trading days of the week, the mean returns for all the trading days showed different distributions.

2 The standard deviation of returns series maximum occurred on Monday for both indices, implying that utmost volatility is found on Monday alone. These results suggest that for intraday traders, Monday is an appropriate day for intraday trading.

3 The coefficient value of the Jarque-Bera test statistic is significant at a 1% level for all trading days of S&P BSE SENSEX and NSE Nifty 50 indices. It is also strongly evident that the distribution of the daily returns was asymmetric and confirmed that the daily returns are not normally distributed.

4 The coefficients values of Wednesday are positively significant for S&P BSE SENSEX and NSE Nifty 50 Indices, thus suggesting that the day of the week effect is the Wednesday effect.

6.1 Explanation of calendar effects in Indian stock market

As EMH is challenged by the existence of calendar or time anomalies, we tested in the present research if there are any identifiable short-term time-based patterns in stock returns so that investors can predict future market movements using the past information. Our results indicate that there is a significant day of the week effect on Wednesday alone. Wednesday is the day ruled by the bull market hence, this study advised the investors to sell shares on Wednesday and buy shares on other trading days. We would like to mention that one of the limitations of this study is that the effect of ex-dividend on stock prices is not considered. Typically, on the ex-dividend day the stock prices tend to fall and prior to the ex-dividend day, stock prices increase. Our results indicate, ceteris paribus, the volatility of stock prices during the week.

Further, according to modern finance theory, investors' decisions are influenced by psychological factors. In India, investors consider Wednesday the most optimistic day, which coincides with the Wednesday effect, as evidenced by this study. In addition to data revealed by stock market returns, investors are guided by psychological and behavioural factors such as greed, fear, luck, and mental accounting and may not make rational decisions. Therefore, it is not surprising that investors may follow some Muhurat (auspicious) trading days (for example, 24 October 2022, which happens to be Lakshmi Pooja in Diwali time). Similarly, Wednesday is considered an auspicious day for most spiritual and religious-oriented investors.

In addition to the Wednesday effect, the findings from this study also indicate maximum volatility on Monday. One operational implication of this finding is that Monday is good day for the intraday traders. Investors find it profitable to engage in trading on Monday.

The above implications of statistical results apart, one needs to understand the behavioural pattern of individual and institutional investors to explain the calendar effects. If the individual investors are amateur speculators, who may be interested in short-term lending before Friday and make significant investments on Wednesday. This may be over-generalisation and just intuitive guess. On the other hand, institutional investors may play an insignificant role as they assume to trade either on Monday or

Friday. Researches in the field of behavioural finance attempt to find explanation for the calendar effects. For instance, in one research conducted on investors' behaviour in India, it was reported that individual investors were influenced by information cascades, anchoring, and herding (Raut et al., 2018). In another study it was documented that the major behavioural factors significantly influencing the investment decisions were anchoring, mental accounting, disposition effect, herd behaviour, loss aversion, and overconfidence (Vijaya, 2016) [for more elaborate discussion of behaviour of individual investors refer to Barbera and Odeanb (2013)].

6.2 Conclusions

The study investigated the day of the week effect in Indian stock markets through S&P BSE SENSEX and NSE Nifty 50 Indices. The sample included from 1st April 2011 to 31st March 2021, which consisted of ten years. To identify the day of the week effect proper dummy variable was added to the OLS regression equation. Every model having the serial correlation and has been removed by adding appropriate autoregressive integrated moving average (ARIMA) terms to the equation as per Box-Jenkins methodology. Moreover, the ARCH-LM test revealed that the heteroskedasticity effect persists in the models. Therefore, GARCH model was applied to take care of heteroskedasticity effect. The empirical finding of the study reveals that the values of the coefficients of Wednesday are positively significant for S&P BSE SENSEX and NSE Nifty 50 Indices. Moreover, both indices have a significant day of the week effect on Wednesday alone. Therefore, the test strongly exposed the day of the week effect as the Wednesday effect. It is the day ruled by the bull market hence, this study advised the investors to sell shares on Wednesday and buy shares on other trading days. Moreover, the study also identified that utmost volatility is found on Monday alone so for the intraday traders, Monday is an appropriate day for trading.

Acknowledgements

We would like to thank Professor Mostaq Hussain, the Editor-in-Chief, and the anonymous reviewers for their constructive suggestions in the earlier version of the manuscript.

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