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Day of the week effect on S&P BSE auto index in India

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Abstract
The stock market is the primary source for any company to raise funds for business expansions. Investors want to predict the market to earn more returns on their investments. During the development of Indian stock market, researchers have tried to find whether the Indian stock market is efficient or not. According to the Efficient Market hypothesis, past prices of shares should have no predictive power of future prices. In effect, prices should be random. The efficient market hypothesis (EMH) indicates that all stocks are perfectly priced according to their inherent investment properties, the knowledge of which all market participants possess equally. If the market is not efficient, there will exists some market efficiency anomalies, then the investors can gain some abnormal returns by using well planned strategies within the market. The existence of market anomalies is a contradiction to the weak form of the Efficient Market Hypothesis (EMH). Calendar Anomalies in the stock market are those patterns that cannot be explained by traditional asset pricing models. Examples of such patterns include the January Effect, the Day-of-the-Week Effect and holiday effect. The primary objective of this study is to investigate the existence of day of the week effect in stock price behavior of the S&P BSE Auto stock index. The results of this study will be useful to investors, traders, and arbitrageurs who can formulate profitable trading strategies to capitalize on calendar anomalies. The Securities and Exchange Board of India (SEBI) introduced the Compulsory Rolling Settlement System for stocks on January 02, 2002. This was expected to boost liquidity and thereby reduce the market risk of stocks to a considerable extent. The introduction of Rolling Settlement was also expected to lead to higher equity turnover and thereby potentially impact the anomalous behavior of stock prices. In this context, the study provides further evidence on the anomalous behavior of stocks in the Indian Stock Market during the Post Rolling Settlement Period from April 2002 to March 2016. The post rolling settlement testing period distinguishes this study from other contemporaneous studies on anomalous behavior of stocks in the Indian stock market. The findings reveal that there is no existence of day of the week effect in S&P BSE Auto index in India.

Keywords: day of the week effect, auto index, stock returns, linear regression, strategy

1. Introduction

1.1 Background of the study

The concept of stock market efficiency acts as a central paradigm in explaining the behavior of share prices which are governed by rational, emotional, economic, geographical, and psychological factors. Predicting the behavior of stock market is considered one of the most challenging tasks performed by the researchers and securities analysts the world over. Even so, for decades, investors whether individual or institutional, have always been interested in finding an answer to the question of how securities are priced (Ziemba and Hensel 1994). However, it is believed that when a security price and its value vibrate randomly together, an equilibrium exists in such a manner that they are continuously equal with the passage of time.

In fact, the term market efficiency is used to explain the relationship between information and share prices in the capital market literature as it is perhaps the most important concept especially in terms of understanding of the working of capital markets. It assumes greater importance as the trend of investments is accelerating in these markets both because of regulatory reforms and removal of other barriers from the international equity investments. This term is used to depict the ability of the stock market to process information with respect to speed and quality. As a result, it is the speed of this price adjustment process which reveals exactly how efficient a market is.

This hypothesis has also occupied significant proportion of research since the 1970s. In fact, the share prices appear to follow a random walk and it is of much interest to either prove it or to disprove it. For this purpose, a model of share price behavior was required to explain the random walk and this gap was filled by a more general model based on the concept of efficiency of the markets in which shares are traded i.e., the Efficient Market Hypothesis (EMH) (Fama 1965). The EMH assumes that security prices fully reflect all available information at any given point of time which implies that price movements do not follow any pattern or trends. It further assumes that an efficient stock market must ensure rapid information access, so that it can instantaneously process the information to reflect into security prices.

In the context of security markets, EMH explains how the share prices should behave in an efficient market. As EMH states that in an active market which consists of many well-informed and objective investors, stocks will be appropriately priced by reflecting all available information. If so, no one can beat the market except by taking a higher risk. If the market is not efficient, there will exists some market efficiency

anomalies, then the investors can gain some abnormal returns by using well planned strategies within the market.

The existence of market anomalies is a contradiction to the weak form of the Efficient Market Hypothesis (EMH). The weak form of the EMH states that the market is efficient in past price and volume information and stock movements cannot be predicted using this historic information. This form infers that stock returns are time-variant, that is, there is no identifiable short-term pattern. The existence of the anomalies in equity market suggests market inefficiency, in that investors should be able to earn abnormal rates of return incommensurate with the degree of risk.

Anomaly means deviation from the established principle or a situation or that, which is different from what is normally expected. They are the patterns in prices that are not in accordance with theoretical expectations and anomalies in stock returns are in various forms i.e. large firms versus small firms trading returns, long-term versus short term trading returns, over and under reactions of the firms to information, seasonal effects of trading return and so on. There are large numbers of calendar anomalies documented by researchers and continues to grow. Prominent reported calendar anomalies include Day of the week effect, January effect, turn-of-the month effect, turn-of-the-year effect, and holiday effect. The knowledge of anomalous patterns in stock markets provides an opportunity to investors to earn excess profit simply by following certain calendar rules.

Anomalies, after documented and analyzed by researchers often seem to disappear, reverse, or attenuate. Hence, to test the efficiency of the market and identify the existence of the market anomalies become pertinent. In the present research, an attempt has been made to analyze the day of the week effect in the S&P BSE Auto index in India.

1.2 Day of the Week Effect

The most common calendar anomaly is day-of-the-week effect. According to EMH, expected daily returns on stocks are same for all trading days of the week which indicates that the expected return on a security is same for Monday as it is for Tuesday, as it for Wednesday and so on. Thus, it can be said that trading returns on a stock over different trading days of the week should be evenly distributed. Day-of-the-Week anomaly states that expected returns are not same for all the weekdays. Day-of-the-week Effect implies that there is any day in a week, which is generating or providing statistically significant returns on the stocks held which are more than those provided by other days. For example, if returns of Thursday are significantly higher or lower than returns of other days, it will be termed as Thursday Effect.

1.3 Objectives of the study

1. To test the existence of Day of the Week effect on stock return.
2. To test the efficiency of the stock market.
3. To develop trading strategy for investors based on the calendar effects.

1.4 Hypothesis of the study

The following Hypotheses was developed and tested.

H01: There is no significant difference in the mean returns among the different trading days in a week.

H02: There is no significant difference among the volatility of stock prices for different trading days of the week.

1.5 Methodology of the study

1.5.1 Period of the Study

The Compulsory Rolling Settlement System was introduced by SEBI on January 02, 2002 in the stock exchange. It reduces the market risk of stocks to a considerable extent. The investors get their money/securities much faster, thus enhancing their liquidity. The introduction of Rolling Settlement leads to high turnover and creates impact on the Anomalies Behavior of stock. Thus, an attempt has been made in this study, to identify the day of the week effect on BSE Auto index during the Post Rolling Settlement Period from April 2002 to March 2016. Hence the period of present study covers a period of 14 years from 1 April 2002 to 31 March 2016 (i.e. Post Rolling Settlement Period).

1.5.2 Sources of Data Collection

The present study mainly depended upon Secondary Data and used daily index opening and closing values. The required information of every day's values was collected from PROWESS, a corporate database maintained by CMIE and website stock exchanges (www.bseindia.com). The other relevant information for this study was collected from different Websites, Journals, and Books.

1.5.3 Sample of the study

To study the seasonal behavior of stock prices, the sample selected is BSE Auto index. The data constitutes daily data and the sample period of the study spans from 2002 to 2016.The literature shows that researchers have used only closing prices. Rather average of these four prices can yield better results as it can control volatility up to some extent. Hence, in this study daily close, open, high, and low prices were considered for all sample stocks.

1.5.4 Software Packages

EVIEWS 9 has been used for the econometric modeling.

1.5.5 Tools used for analysis

(i) The daily close, open, high, and low prices of the respective stocks have been taken and average price is calculated and then logarithm return of these prices has been calculated.

(ii) After finding the return, the next step is to check for the normality of the return using the summary statistics like Arithmetic Mean, Standard Deviation, Skewness, Kurtosis and Jarque-Bera test. If the Mean and Median are approximately equal, Skewness is zero, Kurtosis is around three and if the Jarque-Bera value is significant, then it is interpreted that the series follow normal distribution.

(iii) To test the stationarity of the data, Augmented Dickey-Fuller (ADF) test is used where the null hypothesis is that the series have unit root (non-Stationarity).

(iv) Kruskal Wallis test is used to test the equality of mean returns for different days of the week. It ranks the entire set of observations (i.e. higher the value, higher the rank

and vice-versa) and then arranges them into nj x 5 matrix where nj represent the rank of the return and columns represent the day-of-the-week - Monday through Friday.

(v) Cross Correlation is used to estimate the correlation between 2 series

(vi) Linear Regression Model is a standard methodology that is initially employed to test the day of the week effect.

2. Review of literature

1. Julijana Angelovska (2013) [1] in his research entitled "An Econometric Analysis of Market Anomaly - Day of the Week Effect on a Small Emerging Market" examined the existence of seasonal behavior in return and volatility of Macedonian Stock Exchange. The data set used to investigate the day of the week effects in Macedonian Stock Market consisted of daily closing values of MBI10 Index from January 4, 2005 to December 31, 2009. The results differed under different model specifications. The presented data showed that the mean return for the entire period (2005- 2009) was negative on Monday, which could indicate the presence of the Monday effect. But the simple single ANOVA model and dummy variable regression using OLS methodology, could not find stable evidence of presence of day of the week effect, or to reject the null hypothesis. The more advanced models like GARCH (1, 1), EGARCH and modified M-GARCH (1, 1) and M-EGARCH, found evidence about existence of a day of the week effect in Thursday. The predictable movements in asset prices can provide investors with opportunities to generate abnormal returns. In addition, many psychologists believe that investor's psychology can play an important role in causing the anomaly.
2. Mansooreh Kazemi Lari and Abbas Mardani (2013) [2] in their paper entitled "Day of the Week Effect, Annual Returns and Volatility of Five Stock Markets in Southeast of Asia" analyzed the annual returns, returns fluctuation and the day of the week effect for five stock markets in Southeast of Asia (Indonesia, Malaysia, Philippine, Singapore, and Thailand). The data consisted of daily closing prices excluded public holidays of the following indexes: Kuala Lumpur Composite (Malaysia) index; Jakarta Composite (Indonesia) index; Manila Composite (Philippines) index; Straits Times (Singapore) index and SET (Thailand) index for the period of 31, December 2007 to 31, December 2011. Non-parametric tests and parametric test were used for equality of variance returns and equality of mean returns on the daily returns of the week. Graphical representation of indexes annual changes and their correlation were explored to employ this analysis. The results indicated that all the indexes experienced high negative changes in 2008 and after this decline, market index growth enormously. Especially Indonesia experienced the highest increase. There was generally high volatility of returns. The results of the Levene's test of the equality of standard deviations revealed that the mean returns are not equal across the days of the week for all the markets except for Indonesia and Malaysia.
3. Mahendra Raj Damini Kumari (2006) [3] in his research entitled "Day-of-the-week and other market anomalies in the Indian stock market" attempted to investigate the presence of seasonal effects in the Indian stock market. The researcher tested the efficiency of the Indian stock market through many hypotheses. Weekday effects, day-of-the-week, weekend, January, and April effects were examined by applying a variety of statistical techniques. This paper examined the two major indices of the market (BSE & NSE) and a comparison between these helped to verify the existence of seasonality across a large band of stocks. The data used for this study consists of BSE data that comprise of weekly data for the period 1979-1998 and daily data for the period 1987-1998. The NSE data taken were daily and weekly from 1990 to 1998. The daily data was used for the day-of-the-week and weekend effect while the weekly data was used for the January/April effect. All the data points where returns were zero have been eliminated. Also, those weeks where data was not available for all days of the week have been eliminated. The results indicated that though the Indian market does exhibit seasonality in returns, this seasonality is very different from that observed commonly in other markets. The negative Monday effect and the positive January effect has not been observed. Monday returns are significantly higher than the other days of the week even for the calendar time hypothesis.
4. Tariq Aziz and Valeed Ahmad Ansari (2013) [4] in their research entitled "Day of the Week Effect: Evidence from India" investigated the presence of Day of the Week Effect in India. The daily closing prices of BSE Sensex for the period; April 1990 to February 2013 and daily closing prices of S&P CNX Nifty for the period; November 1995 to February 2013 was taken for the study. GARCH framework was used to detect the day of the week effect. The results indicated that Monday effect is non-existent in the two leading market indices, BSE Sensex and S&P CNX Nifty. The results remained robust to the distribution assumptions and sub-periods.
5. Tanima Niyogi Sinha Roy (2010) [5] in his paper entitled "Day -of -the -Week Effects in BSE Bankex" investigated the day -of -the -week -effect on the return and conditional variance of the BSE bank stock index (BSE Bankex) in the emerging stock market of India using close-to-close data during the period after the introduction of rolling settlement. The sample period taken for the

[1] Julijana Angelovska(2013),"An Econometric Analysis of Market Anomaly - Day of the Week Effect on a Small Emerging Market",International Journal of Academic Research in Accounting, Finance and Management Sciences,Vol.3,Issue.1,pp.314–32.

[2] Mansooreh Kazemi Lari and Abbas Mardani(2013),"Day of the Week Effect, Annual Returns and Volatility of Five Stock Markets in Southeast of Asia" Asian Journal of Finance & Accounting,Vol.5,Issue.1,pp.446-461.

[3] Mahendra Raj Damini Kumari(2006),"Day-of-the-week and other market anomalies in the Indian stock market",International Journal of Emerging Markets, Vol.1,Issue.3,pp.235-246.

[4] Tariq Aziz and Valeed Ahmad Ansari(2013),"Day of the Week Effect: Evidence from India", SSRN Working Paper Series(Electronic copy available at: http://ssrn.com/abstract=2349493).

[5] Tanima Niyogi Sinha Roy(2010),"Day -of -the -Week Effects in BSE Bankex", SSRN Working Paper Series(Electronic copy available at: http://ssrn.com/abstract=1799326).

study was from January 1, 2002 to April 30, 2007.The OLS, GARCH, GARCH-M and TGARCH models were used for the purpose of analysis. The findings revealed that returns on Friday were significantly high. The results also revealed that among all the models applied TGARCH model is most appropriate in modeling the movements in BSE Bankex.

3. Analysis

3.1 Analysis of Descriptive Statistics of S&P BSE Auto Index

Table 1 depicts the results of Descriptive Statistics for S&P BSE Auto Index for the period from April 2002 to March 2016. The above Table revealed that there was positive mean returns recorded for all trading days of the week and highest mean return (0.1454) was recorded on Wednesday, with a high risk (Standard Deviation) of 1.16 and the lowest mean return (0.0089) was recorded on Thursday with low risk. This indicates that the Auto industry's risk and returns were directly related. It means high risk with high return and vice versa.

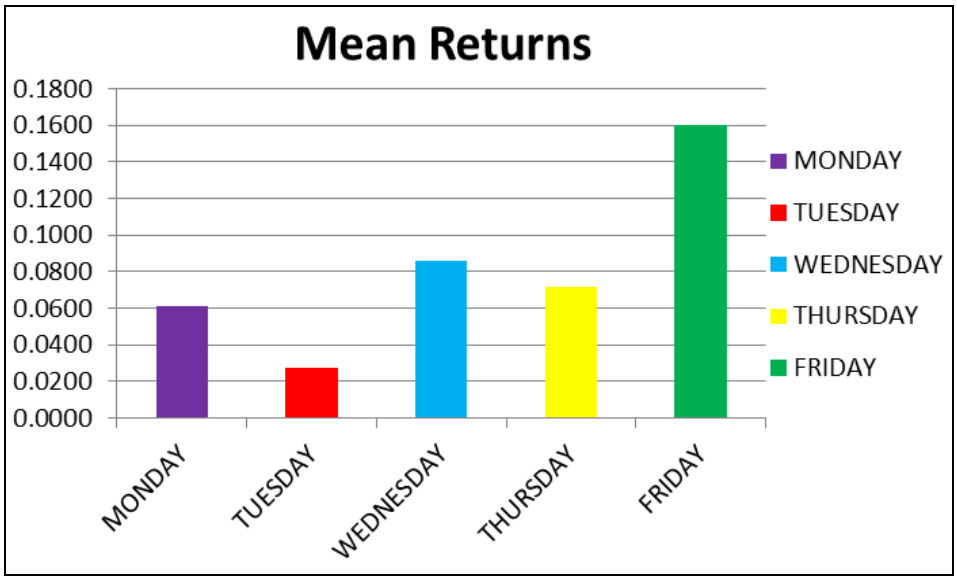
The return distribution was negatively skewed on all trading days of the week. It ranged from -0.3803 to -1.0263. The Kurtosis measure of returns distribution was Leptokurtic for all days of the week, showing the Highest Value (10.43) on Monday and lowest (4.52) on Wednesday. The coefficient value of Jarque-Bera test was significant at 1% level for all trading days. This implies that the returns were asymmetric and did not normally distribute during the study period.

Fig -1 clearly displays the average mean return for S&P BSE Auto Index Returns from April 2002 to March 2016. It is clear from the above Fig that there were positive mean returns for all days of the week and the highest mean return was earned on Friday and the lowest on Tuesday during the study period**.**

Table 1: The Results of Descriptive Statistics for S&P BSE Auto Index Daily Returns from April 2002 to March 2016

Statistics	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	0.0615	0.0277	0.0859	0.0716	0.1603
Median	0.1858	0.0493	0.1205	0.1266	0.2050
Maximum	10.6266	6.3903	4.5924	6.7790	6.9065
Minimum	-9.8571	-6.4091	-5.6137	-7.5177	-11.0126
Std. Dev.	1.6971	1.4785	1.4012	1.4501	1.5975
Skewness	-0.6169	0.1858	-0.1687	-0.5247	-0.4270
Kurtosis	8.3675	5.0315	4.0436	6.0556	7.9408
Jarque-Bera	883.44	124.40	34.83	299.65	717.56
Probability	0	0	0	0	0
Observations	699	700	695	689	685

Source: Computed from E-views.



***Source*:** Computed from Table 1

Fig 1: Average Returns of Trading Days of the Week for S&P BSE Auto Index Returns from April 2002 to March 2016

3.2 Analysis of Kruskal-Wallis Test for S&P BSE Auto Index

The analysis of Kruskal-Wallis Test for S&P BSE Auto Index for the period from April 2002 to March 2016 is given in Table-2. The Kruskal-Wallis Statistics Value of 4.95 was lower than the Table Value of 9.49 at 5% level of significance at 4 degrees of freedom. It clearly points out that during the study period there was no significant difference between the returns of all trading days of the week.

Table 2: The Results of Kruskal-Wallis Test for S&P BSE Auto Index Daily Returns from April 2002 to March 2016

KW Test Statistics	
Chi-Square	4.95
Df	4
Asymp. Sig.	0.292
Degrees of freedom. N-1 4 N= 5	Table value: 1% - 13.277 5% - 9.488

***Source*:** Computed from SPSS

3.3 Analysis of Cross Correlation Test for S&P BSE Auto Index

Table-3 reveals the Results of Cross Correlation Test for S&P BSE Auto Index for the period from April 2002 to March 2016. From the analysis, it is observed that during the trading days of the week, Tuesday negatively Correlated with Wednesday at 5% significant level. The Coefficient value between Tuesday and Wednesday was -0.080 (significantly negative) and the p-value for two-tailed test of significance was 0.03. The remaining trading days of the week does not significantly correlate with other trading days of the week.

Table 3: The Results of Cross Correlation Test for S&P BSE Auto Index Daily Returns from April 2002 to March 2016

Weekdays	Pearson Correlation	Monday	Tuesday	Wednesday	Thursday	Friday
Monday	Pearson Correlation	1				
	Sig. (2-tailed)					
Tuesday	Pearson Correlation	-0.045	1			
	Sig. (2-tailed)	0.233				
Wednesday	Pearson Correlation	0	-.080*	1		
	Sig. (2-tailed)	0.995	0.036			
Thursday	Pearson Correlation	-0.044	-0.009	0.075	1	
	Sig. (2-tailed)	0.248	0.821	0.05		
Friday	Pearson Correlation	-0.039	0.024	0.003	-0.003	1
	Sig. (2-tailed)	0.304	0.523	0.941	0.929	

*. Correlation is significant at the 0.05 level (2-tailed).

***Source*:** Computed from SPSS

3.4 Analysis of Unit Root Test for S&P BSE Auto Index

The Results of Unit Root Test for BSE Auto Index from April 2002 to March 2016 are shown in Table-4. It is clearly analyzed from the above Table that the returns for all days of the week were stationary, which is the test statistics value was higher than the test critical value at Level Difference itself. Further, it was tested with First Level Difference which proved that the returns were stationary with critical Values of (-3.494) and (-2.867) at 1% level, and 5% level respectively. From the overall analysis of the Table, it is found that the returns were stationery at level difference at 1% significant level.

Table 4: The Results of Unit Root Test for S&P BSE Auto Index Returns from April 2002 to March 2016

Weekdays	Significant level	ADF-test	
	Test statistic	Level difference	1st Difference
Monday	Test statistic	-26.612*	-17.439
Test critical values	1% level	-3.494	-3.443
	5% level	-2.865	-2.867
Tuesday	Test statistic	-17.412*	-14.402*
Test critical values	1% level	-3.439	-3.439
	5% level	-2.865	-2.865
Wednesday	Test statistic	-28.393*	-17.021*
Test critical values	1% level	-3.439	-3.443
	5% level	-2.865	-2.867
Thursday	Test statistic	-24.997*	-17.221*
Test critical values	1% level	-3.439	-3.439
	5% level	-2.867	-2.867
Friday	Test statistic	-25.449*	-14.407*
Test critical values	1% level	-3.439	-3.439
	5% level	-2.865	-2.865

***Source*:** Computed from E-Views

*Significant at 1% level.

Note: ADF Test-Augmented Dickey Fuller Test.

3.5 Analysis of Linear Regression Model for S&P BSE Auto Index.

The Results of the Linear Regression Analysis based on the daily data for S&P BSE Auto Index for the period from April 2002 to March 2016 is demonstrated in Table-5. It is clearly understood that during the study period, Positive Coefficient Value was recorded for all trading days of the week except on Tuesday. The Coefficient Value of Friday was high (0.0987) compared to the other days of the week. Further, none of the coefficients was significant at 5% level of significance, indicating that there was no Day of the Week Effects in the S&P BSE AUTO Index Returns. It is to be noted that the adjusted R^2 value was low and negative
(-0.00035). The insignificant F-statistic indicates that the overall fit of the model was poor. Further, Durban-Watson Statistic Value of 1.73 indicates Autocorrelation in the residuals. Therefore, the Null Hypothesis (NH_1), "There is no significant difference among the returns of different trading days of the week", is not rejected. In other words, there did not appear any Day of the Week Anomaly for BSE Auto Index Returns during the study period.

Table 5: The Results of Linear Regression Analysis for S&P BSE Auto Index Daily Returns for the period from April 2002 to March 2016

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Tuesday	-0.0326	0.0817	-0.3989	0.6899
Wednesday	0.0230	0.0818	0.2819	0.778
Thursday	0.0100	0.0820	0.1221	0.9028
Friday	0.0987	0.0821	1.2015	0.2296
C	0.0615	0.0578	1.0643	0.2872
Adjusted R-squared		-0.00035	F-statistic	0.6994
Durbin-Watson statistics		1.7298	Prob (F-statistic)	0.5922

***Source*:** Computed from E-views.

4. Findings

The following were the findings of this Day of the week effect analysis.

- The study found out that during the study period the average returns of S&P BSE Auto earned highest average returns on Friday and lowest returns earned on Tuesday for Auto industry.
- The Kruskal-Wallis Test concludes that there was no significant difference between the different trading days of the week. It means all trading days returns were equal.
- The results of cross correlation test concluded that there was no significant relationship between different trading days of the week.
- The results of Linear Regression Analysis using dummy variables observed that none of the coefficients value was significant at 5% level of significance

It indicated that during the study period, there was no Day of the Week Effect in the S&P BSE Auto index.

5. Conclusion

This study indicates that though the Indian market does not exhibit Day of the Week Effect in returns, this seasonality is very different from that observed commonly in other markets. The variance in seasonality in the Indian market as compared to the other developed markets implies that this market is not yet integrated with the other world markets and can provide a good portfolio diversification opportunity. The study found out that during the study period the average returns of S&P BSE Auto earned highest average returns on Friday and lowest returns earned on Tuesday for Auto industry. The Kruskal-Wallis Test concludes that there was no significant difference between the different trading days of the week. It means all trading days returns were equal. The results of cross correlation test concluded that there was no significant relationship between different trading days of the week. The results of Linear Regression Analysis using dummy variables observed that none of the coefficients value was significant at 5% level of significance. It indicated that during the study period, there was no Day of the Week Effect in the S&P BSE Auto index.

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