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Day of the Week Anomalies in Daily Returns: Evidence from Indian Capital Market

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Abstract
The prevalence of calendar anomalies in general reflects the extent and magnitude of informational efficiency in stock markets. Stocks markets all over the world witness different forms of anomalies and it varies from country to country. The market participants are always on the verge of taking advantage of inefficiencies in the stock market to generate abnormal return. Day of the week anomalies are substantial in terms of contributing to the level of inefficiencies and misrepresent the market. The present paper explores whether there exists day of the week effect on daily returns in Indian Stock Market by using BSE Sensex benchmark index daily value from April 2013 to March 2016. The empirical results based on GARCH model purport that day of the week anomalies are present in Indian stock market. Market participants are expected to devise investment strategies to beat the market and can magnify their average return through proper timing of their investment activities. The finding is fruitful particularly to small investors in relation to their decision regarding the timing of entry and exit from the financial market.

I. Introduction

Financial markets have been witnessing calendar anomalies for the last three decades and the 'day of the week effect' is significant one that attracted many researchers from different economies to explore the issue. The day of the week effect implies that stock return is not independent of the day of the week in which they are generated. The existence of abnormal behavior in return and volatility is well documented in financial literature and it is critical on the part of investors to decide about the timing of entry and exit. The growing use of daily data has led to additional research in the financial literature, specifically extending the analysis of seasonal behavior to include the day of the week effect, the weekend effect and the bank holiday effect. The financial literature on this topic has offered several justifications for these anomalies: the absence of negotiations during the weekends, Monday availability of information regarding responses to generated information during non-listing days; market transaction payment procedures, effects derived from liquidity, etc. This seasonality has been the subject of different studies which detected empirical evidence of abnormal yield distributions based upon the day of the week.

The pioneering work was carried out using data from the U.S. market. The following authors, among others, made important contributions: French (1980), Gibbons and Hess (1981), Lakonishok and Levi (1982) and Keim and Stambaugh (1984). This effect has also been analysed in security markets under an international setting in works by Aggarwal and Rivoli (1989) and Chang, Pinegar and Ravichandran (1993The day of the week effect under a volatility context has not received much attention in the literature. The paper is divided into the following sections. Section II presents a brief review of the financial literature dealing with the anomaly commonly referred to as the day of the week effect. Section III then follows with a description of the database as well as the methodology employed in the paper. The estimations from the GARCH model and the results are presented in Section IV followed by conclusion in the last section.

II. Review of Literature

There is an extensive amount of financial literature in developed markets which focuses on the day of the week effect. French (1980), discovered empirical evidence demonstrating that Monday yields were lower than Friday ones for the S&P 500 Index upon comparing Monday, Friday and weekly average returns for the same index. He observed that Friday returns were greater than the average while Monday returns were lesser than the average. Gibbons and Hess (1981) also came to the conclusion that Mondays resulted in negative returns. Their study was based on a sample of 30 stocks from the Dow Jones Industrial Index.

Gultekin et al. (1983) looked at the stock markets of 16 industrial countries and found evidence for calendar effects in the form of January returns. These effects were exceptionally large in 15 out of 16 countries

studied. Brown et al. (1985) looked at the monthly returns of the Australian stock market. They found the prevalence of calendar effects from December-January to July-August. They attributed this to the fact that the financial year is from June to July in Australia. Mill and Coutts, 1995, looked at the calendar effects on FTSE 100 indices, Mid 250 indices and 350 indices for 1986 and 1992.

Choudhary reported a January effect in UK and U.S. returns (2001), but did not find similar evidence in German returns (2009). Borges criticised the previous methodologies of analysis and modelling of stock returns (2009), and suggested a new methodology (Single Variable Dummy Regression Analysis) to look at day of the week and month of the year effects in 17 European stock indices over the 1994-2007 period (GARCH, bootstrapping, OLS procedures). In country specific returns, significant calendar effects (August and September effects) were found. However, recent studies (Yavrumyan, 2015) suggest that Oslo stock indices do not show any calendar anomalies in the post-global financial crisis period (2015), supporting market efficiency.

In the case of India, the first few studies by Sharma (1977), Kennedy (1977) and Choudhuri (1991) did not offer any substantial evidence for calendar effects or information inefficiencies. Broca (1992) was the first to provide substantial evidence for the day of the week effect when he studied that the daily returns of BSE NATEX led him to conclude that the lowest average returns occurred on Wednesdays. Pandey (2002) documented the presence of anomalies in India's stock markets during the post reform era using the monthly returns data of SENSEX from April 1991 through March 2002 and attributed it to the tax-loss selling hypothesis.

Sarma (2004), using a non parametrical Kruskall Wallis Test, explored the daily returns of SENSEX, NATEX, and BSE 200 for the period from 1st January 1996 to 10th August 2002 for the existence of calendar anomalies. The highest positive deviation was found in the Monday to Friday set of all the indices, suggesting the possibility of abnormal returns through buying on Monday and selling on Friday. Sah (2008) used GARCH modelling to test calendar effects in daily and monthly indices of NIFTY & NIFTY Junior indices and found the presence of day of the week and Patel (2008) also looked at the calendar effects of monthly mean returns in the NIFTY and the junior NIFTY over the study period (January 2005 to December 2008). They found two distinct effects; the November-December effect (where the mean returns for November and December were higher than other months) and the March-to-may effect (where the average monthly returns for March to May were lower than the other nine months). Patel (2012) extended the same analysis to four Asian markets (India, China, Japan, and Hong Kong) and found a similar Monday effect in these markets.

Purohit (2015) looked at the patterns of monthly returns in India and China. Specifically, using a period (1995 to 2013) and found that the 'December effect' existed in India whereas the 'May-effect' occurred in China. They attributed these effects to 'pre-budgetary expectations' in India and increased economic activity caused by festivals for India.

Though substantial literature is available with regard to day of the week effect in the context of developed market, studies pertaining to developing markets are less. In particular, the conclusions are diverse in different markets over the years which provided impetus to undertake research on the day of the week effect.

III. Data and Methodology

The present paper used series of daily price from the BSE Sensex Index of the Indian market. The data spans from April 01,2013 to March 31, 2016. The returns have been calculated as first differences in natural logarithms according to the following expression: where p_t and p_{t-1} are the values of index for period t and t-1, respectively. One of the most common seasonality anomalies is the day of the week effect. This analysis is based on the hypothesis that the yields produced by each security are not independent of the day of the week. An initial approximation that could contrast the day of the week effect can be carried out with a regression model. It includes five dummy variables, one for each day of the week. It is worth noting that even though the corresponding return on a specific day of the week is significantly different than zero, this does not imply seasonality.

To study the day of the week anomalies, this paper starts with a dummy regression model based on standard OLS technique with the following equation:

$$Sensex\ Returns = \beta_0 + \beta_1\ Tuesday + \beta_2\ Wednesday + \beta_3\ Thursday + \beta_4\ Friday + \mu_t \quad \textbf{Equation 1}$$

The regression results may be unreliable if the data series are non-stationary as the study uses time series data. The non-stationary nature of the data series can be verified by Unit-root test; a unit root indicates non-stationary data. The study moves with testing of return series for a unit root using Augmented Dickey Fuller (ADF) tests. A stationary time series is one for which the mean and variance are constant over time; they depend only on the distance or lag between the two time periods and not on the actual time at which they are computed. The presence of a unit root indicates that the given series has become unstable or non-stationary; showing an uneven movement.

The coefficient of ADF test of Sensex return series having zero probability indicate that the series is stationary at first difference. Further, the OLS regression does not address typical properties of time series data

such as the issue of auto correlation and ARCH effect. Hence, the study proposes to use ARCH family of models to accommodate the heteroscedasticity in time series. The standard GARCH (p, q) model introduced by Bollerslev (1986) suggests that conditional variance of returns is a linear function of lagged conditional variance and past squared error terms. A model with errors that follow the standard GARCH (1, 1) model can be expressed as follows:

$R_t = c + \varepsilon_t \ where, \ \varepsilon_t/\psi_{t-1} \sim N\ (0, h_t)$ ***Equation 2***

$and\ h_t = \ \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1}$ ***Equation 3***

The underlying asset being the Sensex Index, the term R_t is replaced by $R_{sensex,t}$ in the mean equation. The mean equation to be estimated is as follows:

$R_{sensex,t} = \gamma_0 + \varepsilon_t$ ***Equation 3***

To study the relationship between day of the week and return, a dummy variable has been introduced in the conditional variance equation where the dummy takes on a value of zero for other week days and a value of one for the specific day. The conditional variance equation to be estimated is as follows:

$h_t = \ \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} + \alpha_3 D_{specific\ day}$ ***Equation 4***

where, D_t is a dummy variable and α_3 is the coefficient of the dummy variable. If α_3 is statistically significant, it can be said that the specific day has had an impact on return.

IV. Empirical Results

The descriptive statistics in Table 1 pertaining to skewness and kurtosis indicate that the series is not normally distributed. Further, the Jarque-Bera test statistics for Sensex returns as shown in Table 1 are statistically significant as well as the time series have excess kurtosis.

Descriptive Statistics for the Period (April 2013 to March 2016)

Descriptive Statistics	BSE SENSEX Return	Monday Return	Tuesday Return	Wednesday Return	Thursday Return	Friday Return
Mean	0.000466	0.000231	0.000246	0.000216	0.000573	0.001089
Std. Dev.	0.007106	0.006104	0.006323	0.00737	0.008007	0.007649
Skewness	-0.300076	-0.287176	0.42474	-0.352867	-0.74945	-0.20726
Kurtosis	3.82785	3.842641	3.294647	4.222102	4.465906	3.815662
Jarque-Bera	21.47668	11.462901	13.30111	18.464271	18.94859	10.82324
Probability	0.000022	0.001211	0.000944	0.000821	0.000127	0.002576

Source: Computed

The output of OLS regression has been documented in Table 2. The coefficients of all the days of the week are different and none of them are statistically significant. The R^2 is very low and the total variation explained is less. Such results can be due to the typical properties of time series data like the stochastic characteristics of data.

Results of OLS Regression for Sensex Daily Return

	Coefficient	Std. Error	t-Statistic	Prob.
Monday	0.000949	0.001099	0.863844	0.3892
Tuesday	-0.148263	0.130193	-1.138797	0.2568
Wednesday	-0.159489	0.099725	-1.599293	0.1121
Thursday	0.039484	0.106992	0.369034	0.7127
Friday	0.019364	0.103483	0.187124	0.8518

Source: Computed

The ADF test for presence of unit root in Sensex Index daily returns have been compiled in Table 3. The results show that the series is stochastic at level having a t-statistics of 0.206017 with insignificant probability value. However, the series is deterministic at first difference with a t-statistic of -46.61417 with a significant probability value.

Table 3: Results of Unit Root Test

Augmented Dickey-Fuller Test Statistics				
Indices	**Price at Level**		**Price at First Difference**	
	t-Statistic	Prob.*	t-Statistic	Prob.*
BSE SENSEX	0.206017	0.973	-46.61417	0.0001

Source: Computed

Further, as a requisite diagnostic, heteroscedasticity test is conducted to explore the heteroscedastic behaviour of financial time series data. The F-statistic is 75.21049 with a significant p-value indicate the presence of ARCH effect in Sensex daily return. The GARCH model is exclusively designed to address the heteroscedastic behaviour of financial time series data.

Table 3: Heteroscedasticity Test: ARCH

Heteroscedasticity Test: ARCH			
F-statistic	75.21049	Prob.	0
Obs*R-squared	72.81359	Prob.	0

Source: Computed

In order to estimate the impact of day of the week on daily return, GARCH (1, 1) model has been adopted. A dummy variable for specific day of the week has been incorporated in the conditional variance equation. The results of the estimation for the impact of specific week days are presented in Table 4.

Table 4: Estimates of GARCH (1, 1) Model

Estimates of GARCH (1, 1) for the period (April 2017 to March 2019)				
	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
Monday	-0.0000259	0.00000918	-2.820877	0.0048
Tuesday	-0.0000348	0.0000114	-3.059552	0.0022
Wednesday	0.0000344	0.0000095	3.62369	0.0003
Thursday	0.0000179	0.0000111	1.61517	0.1063
Friday	-3.57E-06	0.00000799	-0.446689	0.6551

Source: Computed

The coefficients of Monday, Tuesday and Wednesday dummies are exhibiting statistically significant value implying that there exists day of the week anomalies in Indian stock market. The coefficients are -0.0000259, -0.0000348 and 0.0000344 are having significant p-values.

V. Conclusion

The prevalence of calendar anomalies in general reflects the extent and magnitude of informational efficiency in stock markets. Stocks markets all over the world witness different forms of anomalies and it varies from country to country. The market participants are always on the verge of taking advantage of inefficiencies in the stock market to generate abnormal return. Day of the week anomalies are substantial in terms of contributing to the level of inefficiencies and misrepresent the market.

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