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CALENDAR ANOMALIES IN S&P BSE 100 ESG INDEX PERFORMANCE IN INDIA: AN EXAMINATION OF DAY-OF-THE-WEEK EFFECT

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Abstract

Growing concerns about environmental, social, and governance (ESG) issues have fueled the growth of sustainable investing in recent years. However, there is still a significant dearth of awareness among investors about the benefits and significance of sustainable investing.

Investors' lack of knowledge about sustainable investing impedes the widespread adoption of sustainable investment practises. To address this issue, multiple parties must work together to provide information, increase transparency, and dispel myths. In order to build a more sustainable and responsible investing ecosystem, investors need to be provided with ample knowledge and tools to evaluate sustainability factors alongside financial measures.

From inception in October 2017 to May 2023, we examined the performance of S&P BSE 100 ESG Index and correlated it with growing interest for sustainable investing among the investors. The study also investigated weak form efficiency of Indian markets by examining day-of-the-week effect in returns of S&P BSE 100 ESG Index in India. The findings indicate that investment in sustainable enterprises in India has resulted in competitive returns. The study provides evidence of presence of day-of-week effect with Tuesday returns being significantly higher than the other days of the week. The study provides scope for researching the other anomalies considering the impact of regulatory frameworks, investor behaviour, and sector-specific dynamics to understand the relationship and interest among investors towards sustainability investment in India compared to bourses. This study thus helps to examine the investment decisions and growing interest among industry to practice and report sustainable practises.

Key words: Sustainability, ESG, Calendar anomalies, Day-of-the-week effect, Weak form efficiency, Sustainable investments

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1. INTRODUCTION

Over the past 10 years, the investment landscape in India has undergone significant transformations. Some of the key factors which has contributed to this changing landscape are many. But predominantly it was the emergence of technology and digitalization which revolutionized the way investments were made. Online trading platforms, mobile applications, and digital payment systems have made investing more accessible and convenient for a wider range of individuals.

Secondly, the regulatory environment has undergone substantial reforms to attract both domestic and foreign investments. Initiatives such as the introduction of the Goods and Services Tax (GST), the implementation of the Insolvency and Bankruptcy Code (IBC), and the liberalization of foreign direct investment (FDI) policies have improved the ease of doing business in India.

Thirdly, there has been a significant shift in investor preferences towards long-term and sustainable investments. Investors are increasingly considering environmental, social, and governance (ESG) factors in their decision-making process. This trend can be attributed to a rise in sustainability concerns and an understanding of the financial benefits of ethical investing. But, what is especially noteworthy is the rise of fintech startups and alternative investment platforms has disrupted traditional investment models.

But, irrespective of the India's demographic dividend, with large and young population contributing to the changing investment landscape, less awareness is observed towards sustainable investment. Sustainable investing has gained significant momentum in recent years, driven by growing concerns about environmental, social, and governance (ESG) issues. However, there remains a substantial lack of awareness among investors regarding the benefits and importance of sustainable investing.

One of the key reasons for this lack of awareness is the limited availability of information and education about sustainable investment options (Chidaushe 2022; Thayaraj & Karunarathne, 2021). Many investors are unaware of the various approaches to sustainable investing, such as ESG integration, impact investing, and socially responsible investing. The complex nature of sustainability metrics and the absence of standardized reporting frameworks further contribute to the lack of clarity and understanding (Crona et.al., 2021). But there is a widespread misperception among investors that sustainable investment necessitates compromising financial rewards (Ebaid, 2023). This impression creates negativity in the minds of investors towards the adoption of sustainable investing opportunities, since investors place a premium on short-term financial benefits over long-term sustainable outcomes.

In addition to lack of awareness, institutional awareness and encouragement towards reporting can also act as hinderance (Girón et.al., 2021). Literature provides evidence towards lack of proper training to identify companies following sustainability and awareness about the possible benefits and hazards connected with such investments. As a result, we find less active participation from even high net-worth individuals for sustainable investment options (Pham et.al, 2021).

To address this issue, there is a need for increased education and awareness campaigns targeting investors. Financial institutions, regulatory bodies, and industry associations should collaborate to develop comprehensive educational resources and training programs to enhance investor knowledge about sustainable investing. These initiatives should focus on clarifying the different approaches, highlighting the potential financial benefits, and debunking the myth that sustainable investing requires sacrificing returns (Gleißner et.al. 2022). Furthermore, standardization and

transparency in sustainability reporting are essential to provide investors with consistent and comparable data on the ESG performance of companies. By establishing clear metrics and reporting standards, investors can make informed decisions and assess the long-term sustainability risks and opportunities associated with their investments.

Investment performance in sustainability-based indices has gained significant attention in recent years. These indices provide a framework for investors to allocate their capital to companies that prioritize environmental, social, and governance (ESG) factors. Studies have shown that sustainability-focused investments can deliver competitive financial returns while also addressing critical social and environmental challenges. Research suggests that companies with strong ESG performance are more likely to exhibit long-term financial stability and resilience. Moreover, these investments often offer lower volatility and downside risk, attracting a growing number of investors seeking both financial gains and positive societal impact. The integration of sustainability criteria into investment strategies has the potential to drive positive change while generating favorable returns for investors. A lot of studies have tried to examine if there is presence of calendar anomalies in the returns of the index. The observed pattern of stock market returns that varies depending on the day of the trading week is referred to as the "day of the week effect." (Aggarwal and Rivoli.,1989; Chaouachi and Dhaou, 2020; Cho et.al., 2006; Condoyanni et.al., 2006; Cross 1973; Gayaker et.al., 2019; Lee et.al., 2006). This phenomenon suggests that market behaviour is different on certain days of the week consistently. The Monday effect, in which stock returns are typically lower on Mondays, and the Friday effect, in which stock returns are typically higher on Fridays, are two commonly studied day of the week effects(Rita and Harjum 2018; Rogalski 1984; Tilica 2014; Alagidede, 2008; Athanassakos and Robinson 2006;). Financial research has been interested in the day of the week effect because it may reveal market inefficiencies and investor behavior. These effects can have an impact on portfolio management and investment strategies if they are understood and analyzed (Jaffe and Westerfield.,1985;Wang et.al., 2013; Zhang et.al.,2016). Thus, this study on calendar anomalies with respect to Day-of-the-Week effect on the S&P BSE 100 ESG Index is unique as it focuses on ESG (Environmental, Social, and Governance) index, which reflects organisations that are thought to have good sustainability practises. This distinguishes it from prior studies that primarily analysed general stock market indices. Investigating the effect of the day of the week in an ESG index provides insight into the relationship between sustainability investing and market anomalies.

2. PROBLEM STATEMENT

The problem addressed in this study is the presence and impact of the day of the week effect in the S&P BSE 100 ESG Index. The day of the week effect refers to the phenomenon where stock market returns exhibit systematic patterns and variations based on the specific day of the trading week. Understanding the presence and implications of this effect in the context of the S&P BSE 100 ESG Index is crucial for investors and market participants who seek to optimize their investment strategies and decision-making. By investigating the day of the week effect in this specific index, this study aims to provide insights into potential anomalies, patterns, and trading opportunities that can contribute to improved portfolio performance and risk management strategies

3. OBJECTIVES OF THE STUDY

1. To investigate the performance of the index over the period and
2. To examine and identify the presence and magnitude of the day of the week effect in the S&P BSE 100 ESG Index.
3. To identify if any specific day-of-the-week exhibits abnormal returns from the average market performance.
4. To provide recommendations and insights for investors and stakeholders on how to effectively navigate the day of the week effect and maximize returns in the S&P BSE 100 ESG Index.

4. HYPOTHESIS OF THE STUDY

The Following hypothesis was examined:

H_0: There is no significant difference in the returns of the index across the various days

H_1: There is significant difference in the returns of the index across the various days

5. DATA COLLECTION AND DATA METHODOLOGY

For the study, the daily closing price data of S&P BSE 100 ESG Index from inception i.e., 26th October, 2017 to May 5th 2023 was considered for a period of 10 years resulting in a total of 1444 observations for the entire period. Considering the weekdays, there were 289 observations for each day of the week. The data was downloaded from Bombay Stock Exchange (BSE) website. For the study, S&P BSE 100 ESG Index was considered instead of the individual stocks which are part of the index as the seasonal effect can be easily detectable in the market indices rather than in individual shares (Officer, 1975; Boudreaux, 1995). As the closing prices of the index is non-stationary in nature, we analysed the returns of the S&P BSE 100 ESG Index. We calculated stock return as the continuously compounded daily percentage change in the closing price of the index as shown below:

$$r_t = ln\left(\frac{P_t}{P_{t-1}}\right) * 100$$

Where, r_t the return in the period "t", P_t is the daily closing share price of the S&P BSE 100 ESG Index for the period "t".

In order to determine whether the index returns data is stationary or not, graphical analysis of sample autocorrelation function (ACF) and the partial autocorrelation function (PACF) was conducted. Along with that, as a formal test of stationarity, Augmented Dickey-Fuller (ADF) test was conducted which helps in regressing the first difference of the series against a constant, the series lagged one period, the differenced series at n lag lengths and a time trend (Pindyck and Rubinfeld, 1998):

The ADF test was carried out by considering with and without the constant and/or trend at 5 lags and 10 lags respectively at 5 percent level of significance. As the data were non-stationary, return form of the data was used for further model building.

In order to examine the presence of Day-of-the-Week effect, dummy variables were created for each day of the week. In order to avoid dummy variable trap, an intercept term along with dummy variables for all day except Monday was considered. The omitted day is thus considered to be benchmark month. Thus, the coefficient of each dummy variable measures the incremental effect of that day relative to the monday. Thus, we would conclude the presence of the anomaly, if the coefficient of at least one day represented by a dummy to be statistically significant.

Thus, the model used is as follows:

$$r_t = \alpha_t + \beta_1 D_{tuesday} + \beta_2 D_{wednesday} + \beta_3 D_{thursday} + \beta_4 D_{friday} + \varepsilon_t$$

The intercept term α_1 indicates the average returns for Monday and other coefficients mainly $\beta_1 \ldots \beta_4$ represent the cumulative effect of returns in Monday with other days of the week. Seasonality is found to be evident if the coefficients are statistically

significant at 5 percent level. The problem with this approach is that the residuals may have serial correlation. Thus, ARIMA model is constructed on the residual series. Thus, the following equation was used to include ARIMA factor into the regression model.

$$r_t = \alpha_t + \beta_1 D_{tuesday} + \beta_2 D_{wednesday} + \beta_3 D_{thursday} + \beta_4 D_{friday} + \phi^{-1}(B)\theta(B)\eta_t$$

where η_t is a normally distributed error term and it may have different variance from ε_t (Pindyck and Rubinfeld, 1998).

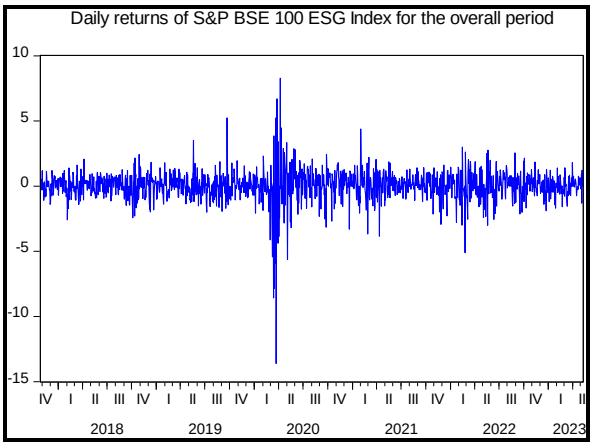
Also, we check for ARCH effect in the residuals. As there was found no ARCH effect, we did not consider in the model building.

6. ANALYSIS AND INTERPRETATIONS

As observed in Figure-1 and Figure-2, the returns form of the data is observed to be stationary in nature. We can clear understand from the index prices that, the investment performance in sustainability-based indices has gained significant attention in recent years. As these indices provide a framework for investment community to be more responsible in their investment choices by allocating their capital to companies that prioritize environmental, social, and governance (ESG) factors. From the performance of the index in Figure-1 and Figure-2, it is clearly evident that, sustainability-focused investments can deliver competitive financial returns while also addressing critical social and environmental challenges. Research suggests that Indian companies over the years have shown strong ESG performance depicting and exhibiting long-term financial stability and resilience. Considering the Figure-2, these investments have been observed to offer lower volatility and downside risk, and thus can help in attracting a growing number of investors in the coming future also who are seeking both financial gains and positive societal impact.

Figure-1: Closing prices trend of S&P BSE 100 ESG Index for the overall period

Figure-2: Daily returns of S&P BSE 100 ESG Index for the overall period



Thus, we can infer that, responsible investing is encouraged by the S&P BSE 100 ESG Index, which promotes sustainable practices among Indian businesses and investors can evaluate their returns with other indexes to forgo any misapprehensions they have towards these indexes.

In order to examine the performance of the index for the entire period from 26th October 2017 to May 2023, descriptive statistics of the index for the overall period and across various days of the week was obtained as shown in Table-1.

Table 1: Descriptive Statistics S&P BSE 100 ESG Index for the overall period

Overall Period (26th Oct 2017-May 2023)						
	Mon	Tue	Wed	Thu	Fri	Overall Period
Mean	-0.12398	0.22976	0.056379	0.012218	0.039337	0.042765
Median	0.12276	0.145008	0	0	0	0.043967
Maximum	4.385765	8.28581	6.69881	4.477405	5.23421	8.28581
Minimum	-13.6088	-2.83663	-5.93931	-8.57777	-4.12189	-13.60881
Std. Dev.	1.520478	0.998056	0.987902	1.137308	1.091098	1.167332
Skewness	-3.2416	1.935953	0.210801	-1.62956	0.445068	-1.474105
Kurtosis	26.37134	17.30576	14.37207	16.11178	7.176106	23.45232
Jarque-Bera	7083.526	2644.91	1559.416	2190.488	219.5461	25690.53
Probability	0	0	0	0	0	0
sum	-35.8291	66.40056	16.29363	3.518897	11.36845	61.75246
sum Sq. Dev.	665.8135	286.8814	281.0736	371.2257	342.8628	1966.323
Obs.	289	289	289	288	289	1444

As observed from the Table-1, considering the average daily returns of the index for each day of the week over the given period, we observe that, the index experienced slightly negative return on Mondays (-0.12398%), followed by positive returns on Tuesdays (0.22976%), Wednesdays (0.056379%), Thursdays (0.012218%), and Fridays (0.039337%). The overall period mean returns were observed to be 0.042765%. It is quite evident from the results that, there might be evidence of presence of Tuesday effect in the S&P BSE 100 ESG Index. In order to negate the effect of extreme values, median values were considered. We can confirm that, relatively higher return is observed even on Tuesdays which is having a median value of 0.145008%. Considering the maximum and minimum values we notice that highest return is also observed on a Tuesday with return of 8.28581%, while the lowest return occurred on a Monday, with a value of -13.60881% pointing towards Tuesday effect. The index displayed the highest volatility on Mondays (1.520478%) with relatively lower volatility observed on Wednesdays (0.987902%) and Fridays (1.091098%). The distribution of the returns suggests Mondays to be negatively skewed, while Tuesdays to be positively skewed (1.935953), indicating a longer right tail with more positive returns. All weekdays had positive kurtosis (leptokurtic), with Mondays having the highest value (26.37134), indicating a higher occurrence of extreme returns compared to a normal distribution. Jarque-Bera statistical test was conducted to check if the returns were following a normal distribution or not. The probability associated with the Jarque-Bera test is zero for all weekdays, indicating that the returns do not follow a normal distribution.

Table 2: Augmented Dickey-Fuller Stationarity (ADF) Test results on closing prices and returns

ADF TEST RESULTS ON CLOSING PRICES of S&P BSE 100 ESG Index			
ADF: with constant		ADF: with constant & trend	
5 lags	-0.415717	5 lags	-2.017607
	-2.863335		-3.412925
10 lags	-0.415717	10 lags	-2.017607
	-2.863335		-3.412925
ADF TEST RESULTS ON RETURNS of S&P BSE 100 ESG Index			
ADF: with constant		ADF: with constant & trend	
5 lags	-16.10576	5 lags	-16.10591
	-2.863335		-3.412925
10 lags	-16.10576	10 lags	-16.10591
	-2.863344		-3.412938

As observed in Table-2, Augmented Dickey-Fuller (ADF) test was conducted to determine the stationarity of the time series. The ADF test examined whether a unit root is present in the overall data considered and which would indicate that the series is stationary or non-stationary. Thus the null hypothesis considered was, the series is non-stationary in nature against the series is stationary in nature. Based on the provided ADF test results on the closing prices and returns of the S&P BSE 100 ESG Index, we can observe the following:

Considering with constant, the ADF test statistic with 5 lags and 10 lags is -0.415717. The test statistic is observed to be within the critical region, indicating that the series is non-stationary and has a unit root at a 5% significance level. Similarly considering with constant and trend, we observe the series to be non-stationary in nature has a unit root at a 5% significance level. But, it is clearly evident from the ADF test results on returns, that the series is stationary and does not have a unit root at a 5% significance level with constant, constant and trend as test statistic values are more negative than the critical values. Thus, the results show consistency with different lag structures and also with the presence of the intercept or intercept and trend. Thus, ADF tests prove that the S&P BSE 100 ESG Index return series is stationary. This was also confirmed by ACF and the PACF of the series. The autocorrelation function falls off quickly as the number of lags increase. This is a typical behaviour in the case of a stationary series. The PACF also does not indicate any large spikes.

In order to examine the presence of calendar anomalies in the form of Day-of-the-Week effect regression model including day-of-the-week dummy variables was examined. The results are shown in Table-3.

Table 3: The Regression Model results of Day-of-the-Week effect

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-0.124	0.068	-1.812	0.070
D2 (Tue)	0.354	0.097	3.655	0.000
D3 (Wed)	0.180	0.097	1.863	0.063
D4 (Thur)	0.136	0.097	1.406	0.160
D5 (Fri)	0.163	0.097	1.687	0.092
R^2	0.009391		F-stat	3.410508
D-W stat	2.040520		Prob.	0.008736

As observed, none of the coefficients except Tuesday is observed to be significant. the constant term represents the expected return on the S&P BSE 100 ESG Index on the reference day (i.e., Monday). The coefficient of -0.124 suggests a negative expected return but the coefficient of 0.354 on Tuesdays indicates that, on average, have a positive effect on the index returns. Thus, Tuesdays tend to have higher returns compared to Mondays. Other days of the week though insignificant were observed to have positive returns but not as pronounced as Tuesdays. The R-squared value of 0.0094 indicates that the day-of-the-week variables explain only a small proportion of the overall variation in the returns of the S&P BSE 100 ESG Index. The F-statistic of 3.412 tests the overall significance of the regression model and is found to be statistically significant at the 5% level, indicating that the regression model as a whole is a good fit. The Durbin-Watson statistic of 2.041 tests for autocorrelation in the residuals. A value close to 2 suggests no significant autocorrelation. In this case, the value suggests that there is no significant autocorrelation in the residuals. Overall, the regression model suggests that Tuesdays have a positive returns while Wednesdays, Thursdays, and Fridays have a weaker yet possibility of obtaining positive return. However, it is important to note that the day-of-the-week effect explained only a small portion of the overall variation in returns, indicating the presence of other influential factors. the sample autocorrelation and partial autocorrelation functions for the residuals. To confirm whether serial correlation is present or not, ACF and PACF values were examined. The steadily declining autocorrelation function implies that the residuals series is stationary and there is no presence of autocorrelation. A Lagrange Multiplier (LM) test for the presence of the ARCH effects in the residuals, confirms no presence of heteroscedasticity in the data.

After experimenting, we fit the ARIMA (1,0,0) model to the residual series. The results of the model are given in Table 4. The Ljung-Box Q-statistic to order of 36 is observed to be insignificant. Thus, we can conclude that the residuals of the ARIMA model are white noise.

Table 4: The Regression Model results of Day-of-the-Week effect with ARMA(1,0,0) fitted for residuals

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	-0.124	0.063	-1.978	0.048
D2	0.354	0.108	3.289	0.001
D3	0.180	0.102	1.767	0.078
D4	0.136	0.090	1.511	0.131
D5	0.163	0.100	1.629	0.104
AR(1)	-0.020	0.014	-1.412	0.158
SIGMASQ	1.348	0.020	67.659	0.000
R^2	0.017423		F-stat	2.825355
D-W stat	2.023558		Prob.	0.002690

Table-4 presents the results of the regression model examining the day-of-the-week effect on the S&P BSE 100 ESG Index incorporating an ARMA(1,0,0) model for the residuals. As clearly evident, all the coefficients except for Tuesday are found to be statistically insignificant at 5 percent level of significance. The coefficients for Tuesday, Wednesday, Thursday and Friday indicating the expected additional return on each respective day compared to Mondays were observed to be positive in nature. The R^2 is 0.017 and the D-W statistic is very close to 2. The sample autocorrelations for the residuals of the model are almost zero. Further, the Ljung Box Q-statistic is mostly insignificant. Thus, the residuals of the model are white noise. Hence, our estimations do not suffer from the problem of serial correlation. Overall, the regression model results with the ARMA residuals suggest that there may be a presence of day-of-the-week effect in S&P BSE 100 ESG Index returns.

7. CONCLUSION

In conclusion, our research adds to the existing body of knowledge in the field of calendar anomalies by examining day-of-the-week effect on the S&P BSE 100 ESG Index returns. Though the day-of-the-week effect has been extensively studied in financial markets, aiming to identify whether specific days of the week exhibit abnormal returns which have provided mixed evidence to the presence and significance of this effect. Our analysis contributes to this body of literature by examining the day-of-the-week effect in the context of the S&P BSE 100 ESG Index. The statistically significant coefficients for the Tuesday dummy represents the presence of seasonality in the S&P BSE 100 ESG Index returns. Our results do confirm the Tuesday effect.

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