

THE DAY-OF-THE-WEEK EFFECT IN THE INDIAN STOCK MARKET REVISITED

Satish Kumar*, Geeta Singh**

Abstract *This article investigates one of the most widely researched calendar anomalies, the day-of-the-week (DOW) effect, under which expected returns of financial assets are not identical on all days of the week, in the Indian stock market, represented by the Bombay Stock Exchange's (BSE) index—Sensex from 2000 to 2019. We find that Sensex returns do not exhibit the DOW effect during our 20-year study period. Further, we investigate if this calendar anomaly was present during the global financial crisis of 2008–2009 and post this crisis period, and find that the DOW effect does not exist in either period. In order to take into consideration the presence of outliers due to the crisis period being included in the study period, we winsorize our data at one percent, and still discover no support for the DOW effect. Finally, we show that the DOW effect does not exist in other sectoral indices of the BSE. Though our result suggests that the Indian market is efficient, we suggest testing for other calendar anomalies like the turn of the month, turn of the year, holiday effect, Monday effect, etc. before concluding that the Indian stock market is efficient.*

Keywords: *Day of the Week, Calendar Anomaly, India, Financial Crisis*

JEL Classification: *G12, G13, G14, G15*

INTRODUCTION

Calendar anomalies provide an idea about market efficiency, which is one of the most widely explored issues in the capital markets. Although such anomalies might provide the investors with an opportunity to outperform the market, they violate the main supposition of the efficient market hypothesis (EMH) that any investment technique cannot help them outperform the market and get extra returns. These anomalies include but are not limited to the day-of-the-week (DOW) effect, the January effect, the turn-of-the-year (TOY) effect, the turn-of-the-month (TOM) effect, the Monday effect, the holiday effect, etc. For example, Berument and Kiymaz (2001) study the DOW effect in the S&P 500 index. They report that Wednesdays exhibit the highest returns, while Mondays are associated with the lowest returns. In contrast, Berument and Dogan (2012) find no evidence for the DOW effect in the US equity market from 1952 to 2006. Agrawal and Tandom (1994) show that a daily seasonality is present in the equity markets of 18 economies; however, this effect mostly vanishes in the 1980s. Similarly, Aggarwal and Rivoli (1989) report the presence of DOW effects in four Asian developing countries. Alexakis and Xanthakis (2006) provide support for the DOW effect in the Greek equity market from 1985 to 1994, indicating that returns are

not indistinguishable on all days. Various studies provide different evidence for the same market during different time periods, which might be due to the evolving nature of these markets (Kumar, 2015). Some have become more efficient over time, others have not changed.

We study whether the Indian stock market exhibits the DOW effect in different time periods. To do so, we consider the daily returns for the main index of the Bombay Stock Exchange (BSE), the Sensex, from 2000 to 2019. We further divide the period into three sub-sample periods on the basis of the global financial crisis as the “pre-crisis, during-crisis and post-crisis periods.” Based on Eng et al. (2019), we consider the period of crisis from January 2008 to December 2009. We conduct OLS regression on the full sample period, including and excluding the two years of the global financial crisis, and on the three sub-sample periods. We find that the Indian stock market does not exhibit the DOW effect in any of the periods, and the average returns on all the days of the week are not significantly different from each other. Further, the robustness test also confirms our findings.

The article is structured as follows: Section 2 details about the main literature; Section 3 presents the data and the methodology. Section 4 highlights the empirical results. Section 5 presents the robustness check of our results and finally, Section 6 gives the conclusion and summary.

* IBS Hyderabad (ICFAI Foundation for Higher Education), Hyderabad, Telangana, India. Email: satishwar1985@gmail.com

** IBS Hyderabad (ICFAI Foundation for Higher Education), Hyderabad, Telangana, India.
Email: geeta.singh25august@gmail.com

LITERATURE REVIEW

Several studies have examined the calendar anomalies globally to test the EMH. For instance, Jacobs and Levy (1988) examine the TOY effect, the weekly effect, and the monthly effect. Similarly, Cadsby and Ratner (1992) study the calendar anomalies in the equity markets of five countries. The DOW effect is based on the violation of the underlying postulation that the expected returns of the financial assets are similar and independent of the day of the week. In contradiction to this assumption, various studies provide evidence that expected returns on assets differ on different days of the week. Gibbons and Hess (1981) provide one of the pioneer studies of expected returns of Treasury bills and common stocks being different on different days. They find that the mean of Monday's returns for stocks are significantly lower and below average than other days of the week for stocks and Treasury bills respectively, though they were unable to provide an explanation for this DOW effect. Berument and Kiyamaz (2001) examine the DOW effect in the US stock markets and show that the minimum and maximum returns are observed on Monday and Wednesday, while the minimum and maximum volatility are observed on Wednesday and Friday. Agrawal and Tandom (1994) show that a daily seasonality is present in the equity markets of 18 economies; however, this effect largely disappears in the 1980s. Similarly, Aggarwal and Rivoli (1989) show the presence of day-of-the-week effects in the four developing Asian countries. Alexakis and Xanthakis (2006) provide support for the DOW effect in the Greek equity market from 1985 to 1994, indicating that returns are not identical on all days of the week.

Balaban (2010) reports the presence of the DOW effect in Turkey, a developing economy characterised by an emerging stock market, though the magnitude and direction of these effects vary across the study period. In order to test the efficiency of the Italian stock market, Barone (2003) tests different systematic anomalies: weekend and public holidays, calendar month end and stock exchange month end, and the year end. He finds that the results are similar to those found for the U.S. market. Comparing the cash and futures markets using data for the S&P 500, Cornell (1985) finds that the Monday effect is present in the equity market. However, Dyl and Maberly (1986) find evidence for the existence of a weekend effect in stock index futures, similar to stock prices, but find no other day of the week effect. Jaffe and Westerfield (1985) examine the daily equity returns for four economies: Japan, Australia, the U.K., and Canada, and compare the results with the U.S. return. They confirm the weekend effect in all economies, with the minimum returns on Tuesday, in contrast to the U.S., where the lowest returns

are observed on Monday. The reason for the seasonality of returns is still not clear, and they rule out the explanation of measurement error and settlement procedures.

Keim and Stambaugh (1984) report negative Monday returns in the U.S. equity markets. Pena (2006) studies the Spanish stock market to examine the daily seasonality of returns before and after the Spanish Stock Exchange Reform. He reports very interesting results where positive abnormal returns are found on Mondays before the reform; however, these effects vanish in the post-reform period, establishing that the market's operational efficiency has improved. Solnik and Bousquet (1990) study the Paris Bourse to examine the presence or absence of the DOW effect, considering a particular settlement procedure. Similar to the previously found results for Japan and Australia, they find a strong and persistent negative return on Tuesdays.

DATA AND METHODOLOGY

Data

We have taken the daily closing price of the Sensex, the index representing the movement of the 30 largest companies on the BSE of India. We study 20 years of stock price movements, from January 2000 to December 2019. Further, we divide the full sample period into three subsample periods on the basis of the global financial crisis. Following the classification of the crisis period of Eng et al. (2019), our subsamples are pre-crisis (Jan 2000–Dec 2007), during crisis (Jan 2008–Dec 2009), and post-crisis (Jan 2010–Dec 2019).

Methodology

Different studies define the DOW effect differently. Gibbons and Hess (1981) state that the non-identical nature of the expected returns of Treasury bills and common stocks on different days of the week is the DOW effect. We calculate our returns R_t as:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \times 100 \quad (1)$$

where R_t and P_t signify the returns and prices, respectively. We use the below OLS regression model:

$$R_{i,t} = \alpha_i + \beta_{mon}D_{mon,t} + \beta_{Tue}D_{Tue,t} + \beta_{Thur}D_{Thur,t} + \beta_{Fri}D_{Fri,t} + \varepsilon_{i,t} \quad (2)$$

where $D_{mon,t}$ is a dummy variable that is "1" for a Monday, "0" otherwise. Similarly, $D_{Tue,t}$, $D_{Thur,t}$ and $D_{Fri,t}$ are the dummy variables that are equal to "1" for a Tuesday,

Thursday and Friday, respectively, and “0” otherwise. The α in the above equation (2) indicates the average returns of Wednesday when all the dummy variables assume a value of zero, and ε_{it} is the error term.

The average return on Wednesdays would be different from zero only if α is significant. A positive α indicates that average returns are positive, whereas a negative value means that the average returns are negative. The coefficient β_i indicates that the change in the average returns is more or less than that of the Wednesdays. Therefore, notably positive (negative) β_i imply that the mean returns on Monday, Tuesday, Thursday or Friday are greater (or less) compared to Wednesday’s returns.

MAIN EMPIRICAL FINDINGS

Summary Statistics

We present the Sensex’ daily returns for different time periods in Table 1. We find that the mean returns for the full crisis

period are positive. Similarly, the returns for the pre-crisis and post-crisis periods are also positive; however, during crisis, the returns are negative. The large kurtosis of the returns in all time periods indicates that the return data is not normally distributed. The Augmented Dickey-Fuller values suggest that the indices’ returns are stationary. Further, the plot of Sensex’ returns is shown in Fig. 1.

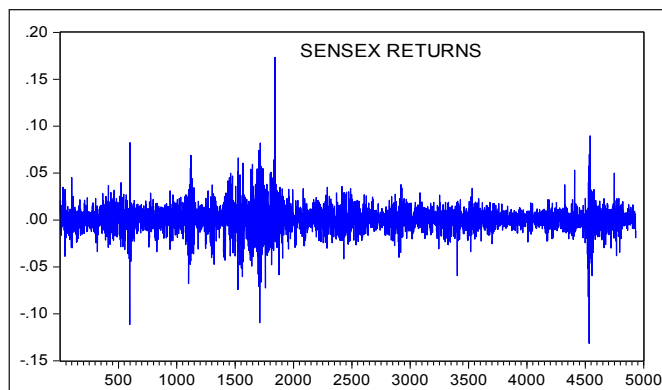


Fig. 1: Sensex Historical Returns

Table 1: Summary Statistics

| | Full Sample with Crisis | Full Sample without Crisis | Pre-Crisis | During-Crisis | Post-Crisis |
|-------------|-------------------------|----------------------------|------------|---------------|-------------|
| Mean | 0.0004 | 0.0005 | 0.0006 | -0.0003 | 0.0003 |
| Median | 0.0009 | 0.0009 | 0.0015 | 0.0002 | 0.0006 |
| Maximum | 0.1599 | 0.0793 | 0.0793 | 0.1599 | 0.0519 |
| Minimum | -0.1181 | -0.1181 | -0.1181 | -0.1160 | -0.0612 |
| Std Dev | 0.0143 | 0.0125 | 0.0154 | 0.0256 | 0.0095 |
| Skewness | -0.1922 | -0.5168 | -0.6098 | 0.2740 | -0.0950 |
| Kurtosis | 11.068 | 8.1644 | 7.0394 | 6.8759 | 4.9805 |
| Jarque-Bera | 1,346*** | 5,158.4*** | 1,480.7*** | 311.6*** | 406.9*** |
| ADF | -65.61*** | -62.42*** | -41.64*** | -20.46*** | -46.62*** |
| N | 4,951 | 4,463 | 1,996 | 488 | 2,467 |

Notes: The table shows the key summary statistics of Sensex’ returns. ADF is the Augmented Dickey-Fuller test for stationarity of the returns. *** means significance at 1% level.

Main Findings

The findings of regression equation (2) for the full period are presented in Table 2. We observe that the Sensex’ returns do not show evidence of the DOW effect. For the full period, including crisis years, the average returns on Wednesday are notably more than zero at the 5 percent level, as indicated by the intercept term. However, the average returns on other days of the week, that is, Monday, Tuesday, Thursday and Friday, are all insignificant at all conventional levels of significance, implying that the returns on all the days

are not different from Wednesday. Thus, in the full sample period, we find no evidence for the presence of the DOW effect. Further, a look at the results of the full sample period excluding the crisis period reveals no different story. We still show that the average returns on Wednesdays’ are significantly higher than zero, as indicated by the significant intercept term; however, the average returns on other days are indistinguishable from Wednesday. Thus, expected returns on all the days are identical, implying absence of the DOW effect in this period also.

Table 2: DOW Effect

| | Full Sample Period Including Crisis | Full Sample Period Excluding Crisis |
|---------------|-------------------------------------|-------------------------------------|
| α_i | 0.00090** (0.04850) | 0.00083** (0.04672) |
| β_{mon} | -0.00062 (0.33261) | -0.00043 (0.46776) |
| β_{Tue} | -0.00068 (0.28712) | -0.00050 (0.39754) |
| β_{Fri} | -0.00071 (0.26797) | -0.00040 (0.49956) |
| β_{Thu} | -0.00048 (0.45564) | -0.00047 (0.42918) |
| N | 4951 | 4463 |
| DW | 1.8577 | 1.8612 |

Notes: The table presents the analysis of the DOW effect for the full sample period with and without the crisis period. Values in the brackets signify the p -value. DW stands for the Durbin-Watson statistic. ** indicates the significance at 5% level.

Sub-Periods Analysis Results

The results of Table 2 get slightly changed when the same regression equation (2) is applied for separate sub-periods. Table 3 shows the analysis of the DOW effect for three different sub-samples: pre-crisis, during, and post-crisis. Now, the average returns for Wednesday is not significant, indicating that it is not different from zero. Further, the average return on the remaining days is also insignificant and, therefore, is also not different from zero. The average returns on all other days are indistinguishable. Therefore, we find no support for the presence of the DOW effect in our considered time-series, even after controlling for the global financial crisis.

Table 3: DOW Effect

| | Pre-Crisis | During-Crisis | Post-Crisis |
|-----------|-----------------------|-----------------------|----------------------|
| Intercept | 0.00112 (0.14849) | 0.00145 (0.56760) | 0.00061 (0.1592) |
| Mon | -0.00103 (0.34730) | -0.00240 (0.51065) | 0.00005 (0.9307) |
| Tue | -0.00034 (0.75911) | -0.00231 (0.52177) | -0.00063 (0.2981) |
| Thu | -0.00032 (0.77073) | -0.00365 (0.31916) | -0.00047 (0.4379) |

| | Pre-Crisis | During-Crisis | Post-Crisis |
|-----|-----------------------|-----------------------|----------------------|
| Fri | -0.00070 (0.52524) | -0.00056 (0.87856) | -0.00029 (0.6385) |
| N | 1996 | 488 | 2467 |
| DW | 1.8569 | 1.8861 | 1.8732 |

Notes: The table presents the analysis of the DOW effect for three sub-samples: pre-crisis, during crisis, and post-crisis period. Values in the brackets signify the p -value. DW stands for Durbin-Watson statistic.

Further, it can be inferred that the crisis has not impacted the efficiency of the Indian market if we measure the efficiency of markets by the absence or presence of calendar anomalies. Thus, we argue that the Indian stock market has turned efficient, considering only the DOW anomaly. However, it does not provide any evidence that the Indian market is efficient, and there is no other calendar anomaly. Our results contradict the findings of Condoyanni *et al.* (1987). Moreover, the results also contradict the work of Raj and Kumari (2006), who take daily data for the period 1987–1998 and find positive Monday returns and negative Tuesday returns in the Indian equity markets.

ROBUSTNESS RESULTS

It may be a concern that the data may contain outliers because of the global financial crisis. There can be very low or high returns before, during or even after the crisis period. To check this, we winsorize full data at one percent, implying that the top 0.05 percent data with the highest average returns is removed and the bottom 0.05 percent data of lowest average returns is also removed. In this way, we lose one percent data; however, this does not change our results. The only change is for the average returns for Wednesday which are now significant at 10 percent level of significance instead of five percent as in the full sample periods including and excluding the crisis period. The average returns on all other days are indistinguishable from Wednesday. Thus, we confirm the absence of the DOW effect in the Indian equity market even after removing the effect of outliers.

We further test the presence of the DOW effect in the different sectoral indices of the BSE. In particular, we collect the data for 11 different sectoral indices such as Auto, Bank, Consumer Goods, Durables, Healthcare, IT, Metal, Telecom, Energy, and Utilities. However, similar to our results for the Sensex, the sectoral indices also exhibit no DOW effect. These findings further support our earlier findings that the Indian stock market is efficient for the considered time period as far as the DOW effect is concerned. Overall, the investors cannot time the market to take advantage of the daily seasonality in the equity market.

Table 4: DOW Effect Winsorized

| | Full with Crisis | Full without Crisis | Pre-Crisis | During-Crisis | Post-Crisis |
|-----------|------------------|---------------------|------------|---------------|-------------|
| Intercept | 0.00072* | 0.00072* | 0.00086 | 0.00074 | 0.00061 |
| | (0.07558) | (0.06765) | (0.22517) | (0.71622) | (0.15330) |
| Mon | -0.00022 | 0.00009 | -0.00002 | -0.00351 | 0.00018 |
| | (0.69827) | (0.87386) | (0.98111) | (0.23775) | (0.76627) |
| Tue | -0.00038 | -0.00019 | 0.00038 | -0.00212 | -0.00063 |
| | (0.50956) | (0.73472) | (0.70678) | (0.46033) | (0.29115) |
| Thu | -0.00063 | -0.00033 | -0.00016 | -0.00354 | -0.00047 |
| | (0.26726) | (0.54878) | (0.86941) | (0.22174) | (0.43130) |
| Fri | -0.00024 | -0.00029 | -0.00015 | 0.00021 | -0.00039 |
| | (0.67598) | (0.60780) | (0.88096) | (0.94354) | (0.51431) |
| N | 4901 | 4441 | 1976 | 460 | 2465 |
| DW | 1.8520 | 1.8526 | 1.8402 | 1.8860 | 1.8795 |

Notes: The table presents the analysis of the DOW effect for the full sample with and without crisis as well as the three sub-sample periods: pre-crisis, during crisis, and post-crisis period – all winsorized at one percent. Values in the brackets are p-value. DW stands for Durbin-Watson statistic. * show significance at 10% level.

CONCLUSION

We show no support for the DOW effect in the Indian equity market, represented by the BSE index movement during the 2000–2019 periods. The global financial crisis has not brought any change in the behaviour of average market returns. Even after removing the outliers from the data, we do not find any support for the DOW effect in India. Further, there is no evidence of the DOW effect in the different sectoral indices of the BSE. However, precaution should be taken before concluding if the Indian market is efficient, since this is just one of the anomalies for commenting on the efficiency of the market. This provides scope for further research to test for other calendar anomalies like the turn of the month, the January effect, the turn of the year effect, Monday effects, the holiday effect, etc.

REFERENCES

- Aggarwal, R., & Rivoli, P. (1989). Seasonal and day-of-the-week effects in four emerging stock markets. *Financial Review*, 24(4), 541-550.
- Agrawal, A., & Tandon, K. (1994). Anomalies or illusions? Evidence from stock markets in eighteen countries. *Journal of international Money and Finance*, 13(1), 83-106.
- Alexakis, P., & Xanthakis, M. (1995). Day of the week effect on the Greek stock market. *Applied Financial Economics*, 5(1), 43-50.
- Balaban, E. (1995). Day of the week effects: New evidence from an emerging stock market. *Applied Economics Letters*, 2(5), 139-143.
- Barone, E. (1990). The Italian stock market: Efficiency and calendar anomalies. *Journal of Banking & Finance*, 14(2-3), 483-510.
- Berument, H., & Kiyamaz, H. (2001). The day of the week effect on stock market volatility. *Journal of Economics and Finance*, 25, 181-193.
- Berument, M. H., & Dogan, N. (2012). Stock market return and volatility: Day-of-the-week effect. *Journal of Economics and Finance*, 36(2), 282-302.
- Cadsby, C. B., & Ratner, M. (1992). Turn-of-month and pre-holiday effects on stock returns: Some international evidence. *Journal of Banking & Finance*, 16(3), 497-509.
- Cornell, B. (1985). The weekly pattern in stock returns: Cash versus futures: A note. *The Journal of Finance*, 40(2), 583-588.
- Condoyanni, L., O'Hanlon, J., & Ward, C. W., 1987. Day of the week effects on stock returns: International evidence. *Journal of Business Finance & Accounting*, 14(2), 159-174.
- Dyl, E. A., & Maberly, E. D. (1986). The daily distribution of changes in the price of stock index futures. *The Journal of Futures Markets (1986-1998)*, 6(4), 513-521.
- Fama, E. F. (1991). Efficient capital markets: II. *The Journal of Finance*, 46(5), 1575-1617.
- Jacobs, B. I., & Levy, K. N. (1988). Calendar anomalies: Abnormal returns at calendar turning points. *Financial Analysts Journal*, 44(6), 28-39.
- Jaffe, J., & Westerfield, R. (1985). The week-end effect in common stock returns: The international evidence. *The Journal of Finance*, 40(2), 433-454.

- Keim, D. B., & Stambaugh, R. F. (1984). A further investigation of the weekend effect in stock returns. *The Journal of Finance*, 39(3), 819-835.
- Kumar, S. (2015). Turn-of-month effect in the Indian currency market. *International Journal of Managerial Finance*, 11(2), 232-243.
- Gibbons, B. R., & Hess, P. (1981). Day of the week effects and asset returns. *The Journal of Business*, 54(4), 579-596.
- Pena, J. I. (1995). Daily seasonalities and stock market reforms in Spain. *Applied Financial Economics*, 5(6), 419-423.
- Raj, M., & Kumari, D. (2006). Day-of-the-week and other market anomalies in the Indian stock market. *International Journal of Emerging Markets*, 1(3), 235-246.
- Solnik, B., & Bousquet, L. (1990). Day-of-the-week effect on the Paris Bourse. *Journal of Banking & Finance*, 14(2-3), 461-468.