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LUNAR PHASES AND STOCK RETURN: INDIAN STUDY

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Abstract

The study aims to understand the lunar phases and its impact on stock return, examining moon related mood swings and investment behaviour. Focus is directed to empirically test the impact of moon phase on stock market return, wherein moon phases are taken as 15 day cycle of new moon and full moon. Stock return was calculated on Stock market index namely BSE Sensex and NSE -Nifty 50 in India. Study confirms that lunar cycle has deep impact on stock market returns for BSE as well as NSE in Indian context. Stock market Investment behaviour specifically, the rate of return on stocks during the 15 days cycle for new moon period exhibit four times the stock market returns as experienced during the 15 days cycle for full moon period.

JEL classification: G4, G1, G14, G40, G41.

Introduction

"Transylvanian effect" is a much studied topic by researchers in psychology field. It highlights the impact of full moon on human activities especially hyperactive or mentally challenged humans. Lot of debate and arguments have taken place around the topic which has resulted in several studies conducted empirical test on full moon link to human behaviour. Much early studies focused on moon phase impact on mental issues. Campbell and Beets (1978) studied moon phase impact on mental illness especially suicides and psychiatric treatments and found no conclusive relation between full moon and mental disturbances citing Transylvania Hypothesis is Type I error. Garzino (1982) highlighted the statistical omissions and misrepresentation of Campbell's study and suggested that missing relationship was due to Type II error.

Campbell (1982) concluded later that research on moon cycle impact on human psychology would be meaningless due to statistical limitations.

A pioneering study was done to study impact of full moon on share market return by Dichev and Janes (2001) and they found substantial link between stock market return data and moon cycles. In their study Dichev and Janes used moon phase dummy to apply in a stock market return regression model, and were able to ascertain positive and significant link between the occurrence of the full moon and market returns. Interestingly they did continue with secondary data to test the result. This methodology was earlier heavily criticized. Transylvanian effect cannot be ignored as it is an established fact that moon's gravity plays an important role on human behaviour. Science establishes that 80 percent of the human body comprises of water. It is because of the human body water content that creates "biological tide" when moon changes cycle to full moon. This in turn can have impact on human behaviour distortions which can deeply impact their decision making especially rationale decisions.

So technically lunatic is phrased to refer irrational behaviour and abnormal psychotic reaction during full moon. The irrational trading behaviour of investors & the unanticipated supply (demand) shocks deviates the stock valuation far below (high) the fundamental value, and makes them very costly to investment strategy aimed at leveraging through arbitrage (Abreu and Brunnermeier, 2003). In such an environment, the over or undervaluation once arrived generates a long-lasting impact on the aggregate market. Following such arguments, there has been a steadily growing literature on the implication of sentiment risk for the determination of stock prices. The word 'lunacy' is thus connected to moon phase and moon phase impact. Thus creating an inference that human psyche ad behaviour shows peaks and troughs as moon cycle changes which in turn relates to their varied decision making in investments, relationships and group behaviour. Indirectly extreme mental abnormality can be related to lunar phases. Therefore, it would be important to study the effect of lunar movements on the stock market activity and decisions especially in an emerging market like India.

Market sentiments & stock return

Earlier evidence of Brown and Cliff (2005) shows that investor sentiment and stock market return are not positively related. Rather they found that US stock market return and investor sentiment showed negative correlation. They had taken consumer confidence as the proxy for investor sentiment and developed the hypothesis which proved this negative relationship between the sentiments and stock market return for the brief period of time. The literature on psychological human behaviour does give numerous evidence on human mood, preferences, choices affected by moon phases.

Evidence was provided on theoretical explanation of human mood swings and human perception and good and bad decisions (Schwarz and Clore, 1983; Frijda, 1988). The mind and mood swing does bring about cognitive and emotional changes that then impacts decisions taken by humans. The reaction mode to situations and the

response duration, and response type to life events, routine decisions and investment decisions shows varied difference in different time periods. Feeling good, bad and low affects orientation towards processing day to day and unique information. Humans especially investors react and response to different information differently in different time period (Schwarz, 1990; Schwarz and Bless, 1991). So moods influence choices and preferences (Loewenstein, 1996; Mehra and Sah, 2000). Hirshleifer (2001) gave gap areas for recurrence periodical study on psyche and behavioural hypotheses.

For the USA Stock markets, Kumar and Lee (2006) show in their research that retail investors, who do not add volume but only noise, evaluate overvalued high cap stocks as compared to growth stocks. Thus he buy–sell imbalance of share-market investors tend to show positive correlation with share market returns of these high cap value stocks.

Maik Schmeling (2009) studied around 18 developed and industrialized countries for their consumer confidence which was taken to represent individual investor sentiment, and its impact on the expected stock market returns. He also concluded that sentiments negatively forecast cumulative stock market returns on an average across countries globally. He also took a cross-sectional perspective and provided evidence regarding the impact of investor sentiment on returns generated by stock market. He suggested that returns are relatively more for select countries that are low on market integrity and to add are culturally critically inclined to group behaviour and herd mentality and overreaction.

Calendar Anomaly & Stock Return

Chan, Khanthavit and Thomas (1996) conducted study to establish influence of culture and rituals on seasonality event in select four. These were Bombay Stock Exchange, the Kuala Lumpur Stock Exchange, and the Stock Exchange of Singapore & the Stock Exchange of Thailand. They have found strong relationship between Chinese New Year impacts on the market returns generated in Stock Exchange of Singapore. While impact of Islamic New Year and evidence of Vesak effects were seen on Stock Exchange of Kuala Lumpur. The authors find that holiday effects on stock market return are insignificant for several Indian lunar holidays. These results strengthen the importance of cultural factors in the pricing of equity stocks. S. Muruganandan, V. Santhi and Arunkumar Jayaraman (2017) identified the day of the week effect in the developing stock market of BRIC nations.

Weather conditions & stock return

Saunders (1993) was the first person to draw the linkage between investment behaviour and weather conditions. Hirshleifer and Shumway (2003) took a total of 26 stock market indices of more developed market across the globe under their study for the period of 1982 to 1997. Kamstra et al. (2003) worked on the impact of the seasonal affective disorder (SAD) on the various stock market returns. He derived the hypothesis based on the psychological and clinical evidences which shows that longer nights cause depression and hence deducted that stock market returns are associated with lower stock returns due to the SAD effect. This hypothesized relationship was confirmed for many international markets later on the same subject. In a different study, he found that returns are particularly lower on the weekends coinciding with the daylight-savings time changes. In 2004, Melanie Cao & Jason Wei worked on to deduce the dependence of stock market return on the temperature anomaly. They examined the potential linkage between temperature and stock returns.

Cultural factors and stock return

Stulz and Williamson (2003) have studied the impact of culture on the rights of company owners and the creditors. It was studied that culture of a particular country, which is symbolized by its religion and historical past, plays an important role in determining creditors' and shareholders' rights. They have found that Protestant countries protect the rights of creditors very well than the Catholic countries. Chakrabarti, Jayaraman and Mukherjee (2004) have studied the impact of factors such as cross border mergers and acquisitions on the stock market returns. They attempted to establish relationship by studying the Hofstede measure of cultural dimensions, which was taken as proxy to define cultural distance. Further it was also used as a alternative measures such as language, religion and legal origin to capture cultural differences in the study.

Lunar effects & stock return

In India the Krishna Paksha denotes the new moon phase while the Shukla Paksha denotes the Full moon phase. Moon phase is important in the Indian cultural factors and their study can be used to highlight interesting aspects of the impact of lunar cycles in the Indian context. The lunar effects being popular and at the same time emergence of discredited theory has impacted researches on the subject.

Increasingly the impact of the lunar cycles on stock market activity & movements in different global markets has been studied. Rotton and Kelley (1985) examined and collected the evidence of 37 different studies on this topic, and concluded that lunar phase influences were "much ado about nothing." A recent updated review, by Kelly, Rotton, and Culver (1996), also found that lunar cycle effects in the existing studies were sporadic, unreliable & usually of little practical interest. Several studies

have highlighted that stock market investors are exposed to various psychological and behavioural biases. These biases affect rationale investment decisions. These investment decisions range from loss-aversion, risk taking, overconfidence, to mood swings (e.g., Harlow and Brown, 1990; Odean, 1998, 1999). Several studies in psychology point out that human behaviour and mood affects individual judgment, response and behaviour (Schwarz and Bless, 1991; Frijda, 1998). The behavioural finance literature has strongly documented impact of mood on diverse asset prices (Avery and Chevalier 1999; Kamstra, Kramer, and Levi, 2000, 2003; Hirshleifer and Shumway, 2003; Coval and Shumway, 2005). It was stated by several studies that impact of lunar phases on mood, indirectly affects investor behaviour and thus their perception of asset prices and its volatility. This then extends to the finding that asset returns in the period of full moon phases will show stark difference from those in the period of new moon phases. As psychological studies link full moon phases and associate it with depressed mood, an inference is deducted regarding stock return during moon phases wherein stocks give less return during full moon periods and vice versa.

Jog and Riding (1989) extended their work to study the impact of moon cycles on stock prices exclusively for Canadian stock markets. They found that no pattern existed for the monthly returns and no correlation exists with lunar cycles. They had used mean daily return for the Canadian stock market Index for the period of 10 years which gave no significant relationship between the two. Dichev and Janes (2003) examined all the major US stock indices and found that there is a strong relationship between lunar cycle effects & the stock returns. In particular, they found that the return in the 15 days during new moon phase is about double the return in the 15 days during the full moon phase. This pattern of returns is pervasive & was found for all the major US stock indices for over past 100 years and for all major stock indexes of twenty-four other countries over the last 30 years. But, the authors were not able to conclude any reliable or economically important evidence of lunar cycle effects on stock return volatility & the volume of trading. The findings of Herbst (2007) supported the efficient markets hypothesis in contrast to all the other findings of his time, which read no consistent, predictable lunar influence, were found on either daily returns or daily price volatility in the Dow Jones Industrial Average, for either new or full moons. Sivakumar and Sathyanarayanan (2007) had studied the impact of specifically the Indian cultural factors on the stock markets in India such as BSE and NSE with the specific focus on Rahu kala (umbra region of the cosmos). The study had found that the Rahu kala had a significant impact on the stock index movement and activity.

Dutta et al. (2006) has developed an artificial neural network to forecast the movements of the Bombay Stock Exchange (BSE) Sensex. The authors show that the artificial neural network is an efficient tool for non-parametric modeling of data where the output is a not a linear function of the inputs. His study shows the importance of studying an emerging market such as India. Bhaduri and Shankar (2007) have

presented some stylized facts about the relationship between the stock market & the corporate investment in India. Based on their findings, Indian stock market were exhibited to show price signals to the Indian corporate houses and investment decisions were thus aggressively determined by a firm's fundamentals.

Research Design - The aim of the study is to understand the impact of the lunar cycle phases on the Indian stock market returns. And how the returns of BSE Sensex and NSE Nifty50 behave during full moon and new moon days. Bombay stock exchange-BSE is India's oldest and Asia's first & the Fastest Stock Exchange in world. BSE Sensex is India's oldest free-float market-weighted stock market index. It comprises of 30 strong and fundamentally sound Indian companies that are listed on Bombay Stock Exchange. The 30 companies comprising the index most actively traded stocks, denotes the diverse industrial sectors of the Indian economy.

Data period-The price return data of the two indices NIFTY 50 and BSE Sensex are closing Price level data on the two indices taken from period 2000 to 2020. Thus, returns for the indices reflect only capital appreciation & excludes the dividends. Based on price levels at closing, the daily return was determined. Daily Rate of return = (Price levelt – Price levelt-1)/Price levelt-1.

Data source -Data for the Bombay Stock Exchange (BSE) are collected from BSE India website, data for the National Stock Exchange (NSE) are collected from NSE India website, and the new moon and full moon dates from the Web site www.timeanddate.com. There are several different lunar cycles but by the most well-known and widely spread lunar cycle is the synodic lunar cycle, which has a periodicity of a total of 29.53 days between two successive new moons.

Lunar cycle

The lunar cycle is basically the period linked to the different positions of the moon, the earth and the sun. The moon transits every 2.5 days around earth. The total lunar cycle is termed for a period of 29.53 days. The full moon cycle occurs halfway in between two successive new moons.

Lunar: 7 day return window

The 7-day stock market return window is defined as new moon or full moon date +/- 3 calendars as shown in figure 1.

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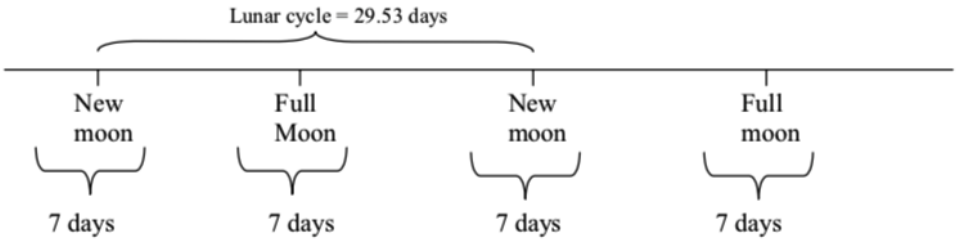
Figure 1



Analysis

In a series of preliminary tests, the study examined the pattern of mean daily returns for the whole lunar month, including visual inspections of return histograms which reveal an interesting regularity in it. It was observed that higher returns tend to cluster around the new moon dates, while comparatively lower returns are clustered around the full moon dates. Following this observation, market returns tests were structured to reflect the probable difference between the new moon and the full moon periods. Specifically, the tests were simple comparisons of mean daily returns for various return windows centered on the new moon date & the full moon date.

For the given data, the study limited the presentation to two return window specifications. The first one (figure 1), compares mean daily returns occurring during one calendar week centered on the new moon date (new moon date +/- three calendar dates) vs. the mean daily returns occurring during the calendar week centered on the full moon date (full moon date +/- three calendar dates). Since the lunar month has a length of about 29.5 days, the first type uses only about a half of the total available daily returns. While the second one uses all the available daily returns and compares the average daily returns for a period of the 15 calendar days centered on the new moon date vs. the 15 calendar days centered on the full moon date. Effectively, the comparison of these two return windows allows one to assess whether possible lunar cycle effects are more dispersed closely around the two locus dates or they are evenly spread throughout the lunar month. The results for Bombay Stock Exchange returns are summarized in Table 1. It presents the results for the Sensex, which is the oldest and significant Indian stock market index. Price level data on this index is taken from 1999 to 2018, a total of 20 years period. Based on price levels at closing, I have computed the daily return for any particular day t as (Price level$_t$ – Price level$_{t-1}$)/Price level$_{t-1}$. Thus, a return for the Sensex reflects only capital appreciation & excludes the dividends. This omission does not seem to be important as returns from the dividends are mostly fixed, & there is no reason to believe that they should be varying by different phases of the moon. An examination of the results for the BSE Sensex reveals

that daily returns around new moon dates are significantly higher than returns around full moon dates. For the 7-day window specification, the mean daily return around new moons is 0.142 percent compared to 0.046 percent around full moons. This difference is large in terms of relativity, with new moon returns more than double the full moon returns. The difference is also huge in the economic terms. If we consider, 250 trading days per year & compounding of daily returns, the annualized difference in returns is 27.11 %, which is much higher than the magnitude of the stock market risk premium in India. The results are roughly the same for the 15-day window mean daily returns for BSE Sensex, although the return difference is marginally lower in this case.

Table 1: Mean Daily Stock Market Returns for both the lunar phases for BSE Sensex and NSE NIFTY 50

Part I: Bombay Stock Exchange -Sensex (1999-2018)

	New Moon Phase	Full Moon Phase	Diff	t statistics (p value)
7-Day Window				
MDR	0.142%	0.046%	0.097%	1.657
SD	0.587%	0.706%		(0.098)
15-Day Window				
MDR	0.094%	0.017%	0.076%	1.777
SD	0.462%	0.496%		(.076)

Part II: National Stock Exchange -Nifty 50 (1999-2018)

	New Moon Phase	Full Moon Phase	Diff	t statistics (p value)
7-Day Window				
MDR	0.146%	0.038%	0.108%	1.913
SD	0.577%	0.674%		(0.056)
15-Day Window				
MDR	0.094%	0.021%	0.073%	1.716
SD	0.458%	0.492%		(0.087)

Figure 1 New moon vs. full moon mean daily returns: BSE Sensex and NSE Nifty 50

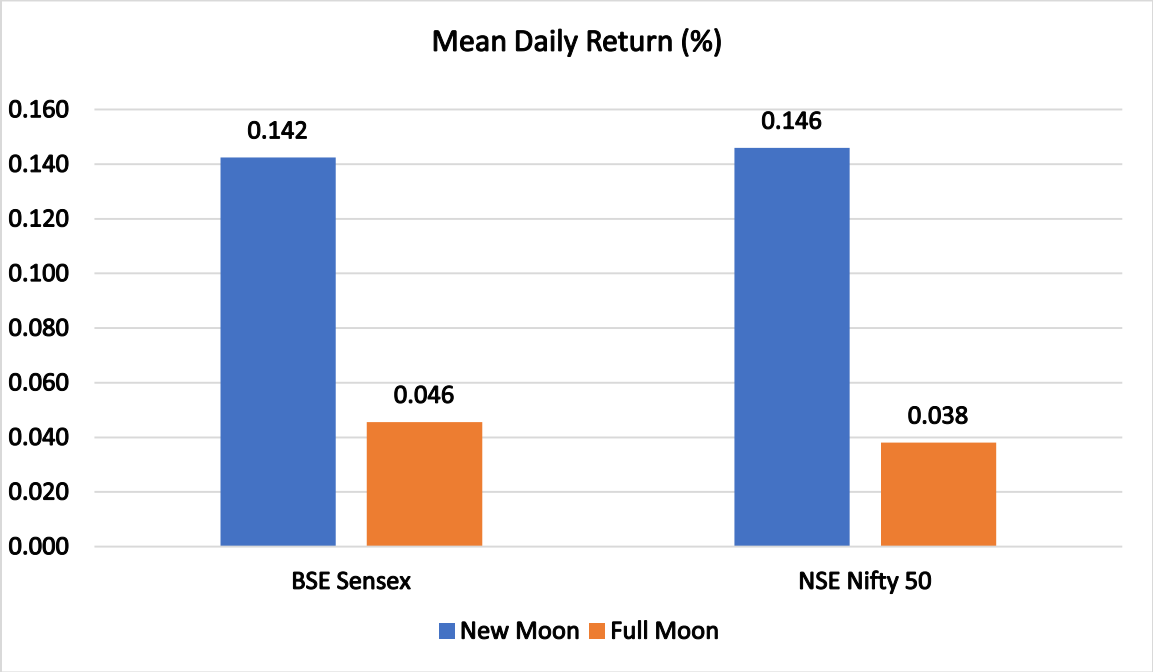
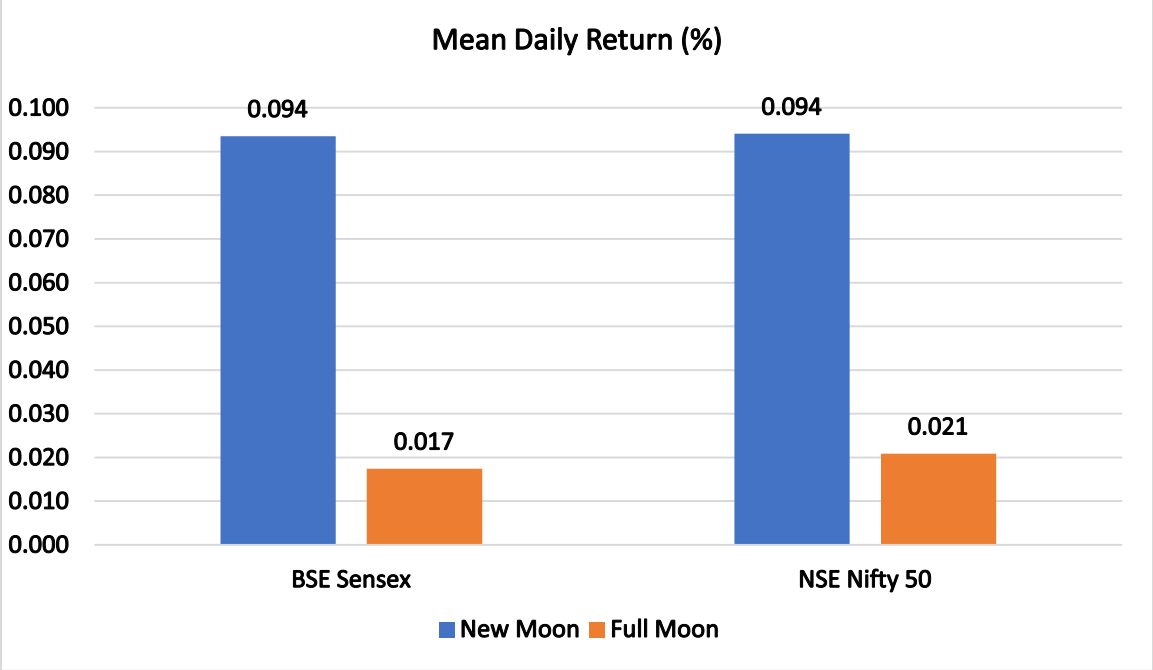


Figure 2 New moon vs. full moon mean daily returns for BSE Sensex and NSE Nifty 50 (15-day window)



In addition to raw returns & differences, the table 1 presents the standard deviation of this mean daily returns, number of daily return observations, and t-test results of the difference in mean daily returns between new moon and full moon windows. Despite of the large difference in market returns, the t-statistics data for both return specifications are insignificant (1.657 & 1.777 for 7-day & 15-day window period respectively). And examining the table for BSE Sensex and NSE Nifty 50 returns and t-statistics, it is evident that the new moon returns are substantially higher than full moon returns in this case as well. Using the convention of 250 trading days as in the earlier case, the range of daily return differences for NSE Nifty 50 translates to a range of annualized differences of 20-28 percent for a 7-day & 15-day window respectively, which ultimately implies that for all specifications the difference is quite large economically.

Conclusion

This research paper documents a lunar cycle impact on stock market returns for Indian stock indexes. Returns around new moon dates are about more than three times the returns around full moon dates. This pattern of returns is quite pervasive and was found that for both the BSE and NSE indexes (Sensex & Nifty 50 respectively) over the last 20 years, the economic magnitude of the new moon and full moon returns difference is quite large, with the annualized differences on the magnitude of 20 to 28 percent, rivaling and & exceeding the market risk premium by much far numbers. Similar to the Monday effect, the theory of the lunar cycle effect in market returns makes it unlikely that it will translate into the exploitable market trading strategies. The results denote that the period of different phases of moon has deep impact on individual behaviour, response, mood and thinking, and affects strongly stock market returns. Strong evidence are exhibited to state that stock returns tend to be lower on specific days which are period around full moon relative to days around a new moon. The return differences tested empirically and show significant deviation for the complete set of sample period. As phases of lunar cycle are already established to exhibit impact on human mind and mood swings they next tend to affect their decisions and thus economic activities. The findings are contrary to regular asset pricing theory for predictions of traditional asset pricing for fully rational investors in a perfect efficient market. The positive link between lunar phases and stock returns suggests that extending rationale asset pricing beyond framework helps to better understand stock market return and investor behaviour in real world.

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