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Day-of-the-Week Effects in the Indian Spot and Futures Markets

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Abstract

The paper studies the efficiency of the Indian equity and futures markets by applying statistical techniques to returns and volatility during trading and non-trading hours. Returns have been decomposed into trading and non-trading period returns by taking close to open, open to close and close to close prices. We find the presence of a weekend effect during the non-trading period in the spot index market, while, there is no day of the week effect in the index futures market. Also, the volatility in both the markets is higher during the trading period than during the non-trading period. Most of the studies on day of the week effects in the futures markets have focused on developed markets. India, even though is an emerging market, is one of the largest derivatives markets in the world. The study throws light on the efficiency of the futures market in the country and also presents a comparison with the spot market. It is also one of the first papers in the Indian context to look at trading and non-trading period returns separately.

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1 Introduction

Starting from Fama (1965), it has been well documented that stock returns and variances exhibit a pattern, which is popularly known as the day-of-the-week effect. This effect challenges the Efficient Market Hypothesis (EMH) of Fama (1965, 1970), as according to the EMH, stock prices should follow a random walk, and not exhibit any predictable patterns.

Cross (1973), followed by French (1980), Gibbons and Hess (1981), Rogalski (1984) find evidence for the presence of a strong Monday effect (negative average returns) for Standard and Poor's (S&P) 500. This phenomenon was also found for the other indices as well as financial instruments like the Dow Jones 30 (Gibbons and Hess, 1981; Keim and Stambaugh, 1984; Rogalski, 1984), CRSP equally weighted and the CRSP value weighted indices (Lakonishok and Levi, 1982), T-Bills (Gibbons and Hess, 1981), Exchange traded and OTC stocks of all sizes (Keim and Stambaugh, 1984) and futures markets (Aggarwal et. al., 2003).

Gibbons and Hess (1981) attribute the day of the week effect to measurement errors, while Lakonishok and Levi (1982) attribute some of these abnormal returns to delay in payments and clearing and settlement during the weekend. However, inspite of controlling for the delays and taking into account the interest components, the returns still demonstrated the Monday and the Friday effect. Rogalski (1984) and Cornell (1985) found that the Monday effect could be explained by decomposing the returns into trading and non-trading day.

After the introduction of Futures trading in April 1982 on the S&P 500 index, Cornell (1985) was the first to try and establish, if the same day-of-the-week effect is carried forward to the S&P500 futures too. Futures prices, by virtue of ideally being contemporaneously perfectly correlated with the price of the underlying, should exhibit the same pattern as the spot prices. However, the reality may be different due to various reasons ranging from transaction costs to volumes of trade in the respective markets to the leverage effect in the futures market. Cornell (1985) found that the Monday effect is absent in the S&P 500 futures market, while it is present in the spot market. Thus they conclude that the behavior of the futures market is in sync with the EMH. However, Dyl and Maberly (1986) found results in sharp contrast to Cornell (1985) for the same S&P500 index futures. They attributed this to possible errors in the data set used by Cornell (1985). They also went ahead and tested for any patterns in the volatility of the S&P500 index futures, during trading and non-trading hours.

This study looks at the presence of the day of the week effect in the spot market and tests for similar effect in the futures market, in the context of the National Stock Exchange (NSE) of India. We also look at the volatility during the trading hours and compare it with the volatility in the non-trading hours for the spot as well as the futures market.

The motivation for this study comes from the fact that firstly, contrasting results continue to be found for different countries and different financial instruments regarding the day of the week effect till date. Secondly, the research on the day-of-the week effect in the futures market has been somewhat limited to the developed nations. It’s because the futures markets have been introduced very recently in most of the emerging nations. Thirdly, according to the World Federation of Exchanges (WFE) and Futures Industry Association (FIA), NSE is ranked as the eighth largest derivatives exchange in the world and it is ranked third in index futures (which we are studying in this paper) globally, in terms of the number of contracts traded. Also, the volumes have been rising at a very fast

pace in the futures market, currently being more than four times the volumes in the cash segment (See Table 1). Inspite of these remarkable numbers, the research focusing on the efficiency of the futures market in India has been limited.

Table 1: Trading Value

Table 1: Trading Value — In Rs millions

Segment/Year	2005-06	2006-07	2007-08	2008-09
Cash Market	15,695,580	19,452,870	35,510,380	27,520,230
Futures and Options	48,242,500	73,562,710	130,904,780	110,104,820

Source: www.nseindia.com

The rest of the paper is organized as follows: Section 2 presents a review of the related literature. Section 3 introduces the National Stock Exchange (NSE) of India. Section 4 discusses the data and methodology. Section 5 presents the results and analyzes them, while section 6 summarizes and concludes the paper.

2 Literature Review

2.1 Spot Equity Markets

There is extensive literature on the day-of-the-week effect in the spot equity markets, for the developed as well as the emerging countries. In the US, the early findings were characterized by persistent negative returns on Mondays (Cross, 1973; French, 1980; Rogalski, 1984). While some of the later works like Berument and Kiymaz (2001) found persistent negative returns on Mondays, but highest returns on Wednesdays. They also find a day of the week effect in volatility, the highest being on Friday and the lowest on Wednesday. Alt et. al. (2002) proposed an alternative approach based on the closure test principle used in

Biometrics and medical statistics and find similar results to those found using the traditional approaches till the 1980's for S&P500, FTSE 30 and the DAX 30. However, they find no evidence for the day of the week effect for the 1990's in all three markets.

Extending the work done in the US to other countries, Jaffe and Westerfield (1985) find significant day of the week effects for the Japanese, Canadian, Australian and the US exchanges, while Agrawal and Tandon (1994) find significant results for the day of the week effects in 18 different countries. Using a GARCH model to account for the conditional variance, Kiymaz and Berument (2003) study the equity markets of Canada, Germany, Japan, UK and the US, and find that the UK, Japan and Canada have the lowest and significant negative returns on Monday, while for Germany and the US, the returns are negative on Mondays and Thursdays but they are insignificant (in contrast to the earlier studies for the US). The highest volatility occurs on Mondays for Germany and Japan, on Fridays for Canada and the United States, and on Thursdays for the United Kingdom. Apolinario et. al. (2006) studied the major European stock markets and find that the day of the week effect in returns was absent in most of the countries. They do find evidence for the day of the week effect in volatility, using symmetric and asymmetric models. In sharp contrast to Apolinario (2006), Chukwuogor-Ndu (2006) found day of the effect in most of the European markets in both returns as well as volatility.

Balaban (1995) studies the Istanbul Securities Exchange Composite Index, which represents the emerging market of Turkey. He finds results in support of Agrawal and Tandon (1994), that is, lowest and negative returns on Tuesdays and highest and positive returns on Fridays. He also finds that Mondays exhibit the highest volatility, while Fridays exhibit the lowest volatility. Alexakis and Xanthakis (1995) found that the day of the week effect in the Athens Stock Exchange exhibited different patterns during different time periods, due to the structural changes in the exchange. Before the changes, the patterns were different

from that observed in the other major exchanges of the world. While after the changes the results followed the same patterns as the others, that is, significantly lower and negative returns on Mondays and higher returns on Fridays. Kenourgios and Samitas (2008) also find results similar to Alexakis and Xanthakis (1995) for the Athens Stock Exchange. However, they show that the effect has weakend during the period 2001-2005, which is in line with the evidence found in the other countries also (Alt et. al., 2002; Apolinario et. al., 2006).

Poshakwale (1996) found the same weekend effect, significantly lower and negative returns on Mondays and higher returns on Fridays, in India. In contrast to these results, using the GARCH model, Bhattacharya (2003) finds evidence in favor of significant positive returns on non-reporting Thursday and Friday. For the same data set, they find different results, significant positive returns only on non-reporting Monday, using the OLS procedure. They also find different results for different sub-periods, indicating that the day of the week effect in both returns and volatility could be a function of the exchange and banking regulations in the country, along with the delay in settlement process. Nath and Dalvi (2005) also find evidence for the day of the week effect for returns on Wednesdays and Fridays, while Mondays and Fridays had significant standard deviations. After the introduction of rolling settlement in 2002, the effect on Friday was significant for returns, while Mondays and Fridays continue to have significantly higher standard deviations. Chander et. al. (2008) also found different results pre and post the introduction of rolling settlement in India. However they find that post rolling settlement, the results conform to those of the more developed markets, with lowest significant negative Monday returns and highest positive Friday returns.

Choudhry (2000) studied seven emerging Asian markets (including India) for day of the week effect using the GARCH model. He found significant effect for both returns as well as the conditional volatility in all the seven countries, though the results for all the countries were not identical. He attributed the day of the week effect for volatility to the availability of different types of information

(public versus private) on different days, while the effect in returns could be due to the spillover from the Japanese market. Chi et. al. (2008) also find the existence of the typical weekend effect in the Singapore, Hong-Kong and the Taiwan markets. Although they find that after accounting for the equity risks, the effect is sustainable only in Taiwan.

Studies have been done on other emerging markets too, like Pakistan (Husain, 2000), Jordan (Al-Rjoub, 2004), Egypt (Aly et. al., 2004), China (Cai, 2006) and UAE (Al-Khazali, 2008). However the results differ for most of the countries.

2.2 Futures Markets

Similar studies have been done for the futures markets too but the studies have concentrated more on the developed nations so far. Also, the number of studies done on the futures market with regard to the day of the week effect is much more limited in number when compared to the number of studies on the spot market.

The cost of carry model states that in an efficient market, in the absence of market frictions, the returns in the spot and the futures market should be perfectly contemporaneously correlated (See Stoll & Whaley, 1990; Chan, 1992; Brooks et. al., 1999). According to this model,

$$F_t = S_t e^{(r-d)(T-t)} \tag{1}$$

where F_t is the stock index futures price quoted at time t, S_t is the value of the underlying stock index, r and d are the risk-free rate and the dividend yield on the underlying index, respectively, T is the expiration date of the futures contract and $(T-t)$ is the time to maturity of the futures contract.

The risk-free rate of interest and the dividend yield on the underlying stock index are assumed as known, constant, continuously compounded rates.

The Cost-of-carry model is a mathematical relationship between the spot and futures market returns. According to this model, the correlation coefficient between the spot market returns and the futures market returns should be one at all times. This also implies that one of these markets should not lead the other market. Information should get assimilated in the prices of the spot and the futures market at the same time and the returns should change equally in both the markets. However, this does not happen in reality. Studies have shown that spot and futures markets exhibit different patterns. Though, even here, the results of different studies contradict each other and there is no conclusive evidence.

Cornell (1985) found that the Monday effect is absent in the S&P 500 futures market. Aggarwal et. al. (2003) find the same for six other futures contracts traded on the Chicago Mercantile Exchange. However, Dyl and Maberly (1986) found that the S&P 500 index futures also display the same negative average returns on Monday as the underlying spot market. Maberly et. al. (1988) find similar negative non-trading period Monday returns for S&P500 futures and VL futures contracts. However, they also find negative Friday returns for trading period, suggesting that the futures market anticipates negative news during the weekend and incorporates it in their Friday prices.

Phillips-Patrick and Schneeweis (1988) find that incorporating the impact of dividend payments for the stock indices and the impact of interest rates for the stock index futures during the weekend do partially explain the ‘weekend effect’ for both the markets.

Chamberlain et. al., 1990 study the NYSE composite index and its futures. The results indicate a statistically significant close-to-open weekend effect in the spot market, with no significant effect in the futures market. Whereas, for the open to close and close to close, the returns are found to be highly correlated for both the markets.

We could not find any studies which look into the day of the week effect in the futures markets of the emerging nations. Though there are many studies which

look into the volatility impact on the underlying or the lead-lag relationships between the spot and the futures markets. We are thus encouraged to study the day of the week effect in one of the largest derivatives exchanges in the world, in an emerging country like India.

3 The National Stock Exchange of India

Derivatives trading on recognized stock exchanges were made legal in India in the year 1999, through the amendment of the Securities Contracts (Regulation) Act, 1956. The beginning was made with index futures contracts based on S&P CNX[1] Nifty Index (Nifty) and BSE Sensitive Index (Sensex) in June 2000 at the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE). Subsequently, futures and options were introduced on individual stocks, other indices, currencies and interest rate too (See Table 2, Evolution of Derivatives Trading in India).

It is evident from the developments in the derivative market during the first half of 2001, that in the course of just three months from February 2001 to April 2001, the derivatives market was transformed from a competitive duopoly to an effective monopoly. The BSE's market share was effectively wiped out in this short period. While NSE accounted for about 99% of total turnover, BSE accounted for less than 1% by 2004-05 and continues to account for less than 1% in 2009.

Index futures and Stock futures are two of the most popular contracts traded on NSE, having a market share of 32% and 31% (by turnover) respectively of the total derivatives market segment as at 31st March 2009. NSE ranks no. 1 in the world in terms of the number of contracts traded for Individual Stocks futures and it ranks 3rd for Stock Index Futures according to the World Federation of Exchanges as at March 31st 2009.

Although there are obstacles regarding growth, overall, the Indian derivatives market is heading in the right direction. It is no longer a market that can be ignored by any serious participant. With institutional participation (both foreign and domestic) set to increase and a broader product rollout inevitable, the market can only widen and deepen further.

Table 2 : Evolution of Derivatives Trading in India

1956	Enactment of the Securities Contracts (Regulation) Act which prohibited all options in securities.
1969	Issue of Notification which prohibited forward trading in securities.
1995	Promulgation of the Securities Laws (Amendment) Ordinance, which withdrew prohibition on options.
1996	Setting up of L.C.Gupta Committee to develop regulatory framework for derivatives trading in India.
1998	Constitution of J.R.Varma Group to develop measures for risk containment for derivatives.
1999	Enactment of the Securities Law (Amendment) Act, which defined derivatives as securities.
2000	Withdrawal of 1969 Notification.
May 2000	SEBI granted approval to NSE and BSE to commence trading of derivatives.
Jun 2000	Trading in Index futures commenced.
Jun 2001	Trading in Index options commenced. Ban on all deferral products imposed.
Jul 2001	Trading in stock options commenced. Rolling settlement introduced for active securities.
Nov 2001	Trading in stock futures commenced.
June 2003	Trading in Interest Rate Futures commenced. Suspended subsequently due to illiquidity.
Aug 2008	Trading in Currency Futures commenced.
Aug 2009	Trading in Interest Rate Futures re-commenced.

Source: Ravi Narain, “Derivatives Markets in India: 2003”, ed by Susan Thomas, Invest India- Tata McGraw Hill, 2003, Chapter 2, Table 2.1, pg.30

Note: The table has been updated up to January 2010 using information from www.nseindia.com

4 Data and Methodology

We have used the daily opening and closing prices data of S&P CNX Nifty Index as well as S&P CNX Nifty futures from 1st January, 2003 to 31st Dec, 2008. The data before 2003, from June 2000 to Dec 2002 has not been considered as the traded volumes in the futures were extremely low. Figure 1 below shows the traded volume in the futures contracts from June 2000 to Dec 2008.

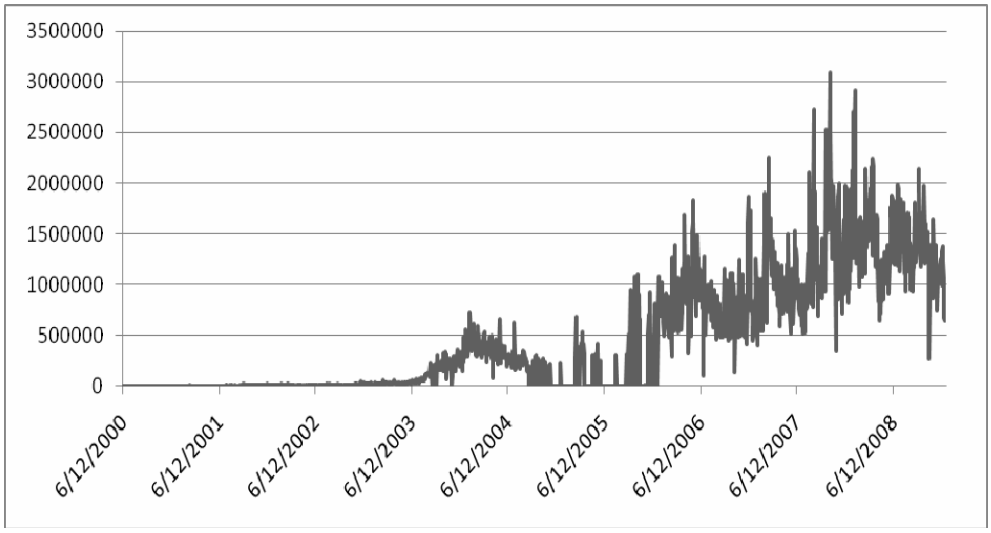

Figure 1: Daily turnover in Index futures from 12th June, 2000 to 31st Dec, 2008

As regards S&P CNX Nifty futures data, at any point of time we have three S&P CNX Nifty futures contract prices available, the near month, middle month and the far month. Since it is the near month contract which is most liquid so for this study we have considered only the near month contracts.

Following Cornell (1985) we delete all holidays and the days following the holidays from the sample i.e. if Monday is a holiday then Friday to Tuesday return

has been deleted. The sample thus contains either one day returns or weekend returns only.

While French (1980) in his paper did talk about the importance of the process through which the stock returns are generated, it was Rogalski (1984), which first decomposed the returns data into trading and non-trading day returns viz, open to close and close to close. Cornell (1985) also decomposed the daily returns into close to close, open to close and close to open for his study. In our study too, we use three different measures of returns i.e. close to close, open to close and close to open. Close to close measure the price difference between closing index value on a day less the closing index value on the preceding day, open to close measure the price difference between the closing price on a day less the open price on that day, close to open measures the difference between the open price on a day less the preceding close price.

In the period of study we had data for 9 Saturdays which we have removed from the sample. Thus the weekend returns for those days have also been removed from the sample. This way the weekend returns (for close-to-close or close-to-open) represent returns from Friday close to Monday close and Monday open respectively. Finally all those days were kept in the samples which were common to the three different return series.

Our initial sample had a total of 1501 observations out of which 80 were deleted on account of holidays thus leaving us with a sample of 1421 observations. As in most of the other studies, Log of price changes has been used to measure returns both in the spot as well as the futures markets. Thus daily returns are computed in the following manner:

$$R_t = Ln(\frac{P_t}{P_{t-1}}) \qquad (2)$$

Where P_t refers to the index level on day t.

However Dyl and Maberly (1986) explain that taking percentage [2] change in prices is not appropriate for the futures prices, as in the futures market,

the investment of an investor is different from the contract value, due to the margin system. Thus price change would be a better measure than the percentage differences as this is what is earned by the investor who enters in a buy-sell or sell-buy transaction in the futures markets. Hence, they take the daily price changes for studying the S&P500 index futures. Black (1976) had concluded the same after looking at the issue extensively. Thus for robustness of results, the returns for the futures market are measured both using the log of price changes as well as daily price change. Thus the following method is also used to measure returns:

$$R_t = P_t - P_{t-1} \tag{3}$$

To check for the weekend effect we use the following dummy variable equation:

$$R_t = a + b_1 D_1 + b_2 D_2 + b_3 D_3 + b_4 D_4 + e_t \tag{4}$$

Where R_t is the return on day t of the CNX Nifty (spot/futures as applicable) Index, D_1 is a dummy variable which takes a value of 1 if the day t is Tuesday otherwise it takes the value of zero. On the same lines D_2, D_3, D_4 are dummy variable for Wednesday, Thursday and Friday respectively. The expected return for Monday is measured by the intercept a, while the coefficients b_1 to b_4 represent the difference between expected return for Monday and other days of the week.

We also check for difference in variances between trading and non-trading periods for all the days of the week. The variance is computed as follows:

$$\sigma^2 = \frac{(R_t - \bar{R}_t)^2}{n-1} \tag{5}$$

Where t refers to the day of the week and $\bar{R}_t$ refers to the mean return for that particular day of the week and n refers to the number of a particular day in our sample.

Table 3: Descriptive Statistics of Log difference of Prices on CNX Nifty Index for the period 2003-2008

Panel A: Close-to-Close

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean*10^{-3}	-0.3	0.94	0.52	0.48	1.61	0.65
SD*10^{-3}	20.5	16.2	15.8	16.6	19.03	17.67
T-stat	-0.24	0.98	0.56	0.49	1.42	1.39

Panel B: Close-to-Open

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean*10^{-3}	0.25**	0.28**	0.18	0.15**	0.21	0.21**
SD*10^{-3}	1.5	1.6	1.6	1.2	1.9	1.57
T-stat	2.76	3.05	1.87	2.15	1.85	5.15

**Significant at 0.01 level

Panel C: Open-to-Close

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean*10^{-3}	-0.55	0.65	0.34	0.33	1.4	0.44
SD*10^{-3}	20.56	16.25	15.8	16.44	18.94	17.6
T-stat	-0.45	0.68	0.37	0.34	1.24	0.93

Table 3 presents the descriptive statistics for CNX Nifty Index returns for various days of the week. While Panel A describes the close-to-close returns, Panels B and C show the descriptive statistics for close-to-open and open-to-close returns. Open-to-close returns is referred as trading period returns, close-to-open is referred to as non-trading period returns, and close-to-close is the total return for trading and non-trading period combined. The results show that open-to-close returns were not significantly different from zero for any day of the week while

close-to-open returns were significantly different from zero for many days of the week i.e. Monday, Tuesday and Thursday. This points out that excess returns can be earned on different days of the week if one buys at close and sells at open while this is not true for trading period returns. This might point to information arriving in the market at the market close rather when the market is open.

Table 4: Descriptive Statistics of Log difference of Prices on CNX Nifty Futures for the period 2003-2008

Panel A: Close-to-Close

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean*10^{-3}	-0.3	1.07	0.76	0.4	1.45	0.68
SD*10^{-3}	22.4	17.5	17.08	17.57	20.6	19.10
T-stat	-0.23	1.04	0.76	0.39	1.17	1.34

Panel B: Close-to-Open

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean*10^{-3}	0.81	0.14	0.84	0.53	-0.06	0.45
SD*10^{-3}	9.8	8.7	9.5	9.4	9.1	9.3
T-stat	1.37	0.27	1.5	0.94	-0.12	1.82

Panel C: Open-to-Close

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean*10^{-3}	-1.12	0.93	-0.07	-0.12	1.5	0.22
SD*10^{-3}	19.35	15.65	15.9	16.05	18.62	17.2
T-stat	-0.97	1.01	-0.08	-0.13	1.36	0.50

Tables 4 and 5 show the descriptive statistics for the CNX Nifty Futures using the two methods of computing returns explained above. None of the return series are significantly different from zero thus showing that the investors are not

able to earn returns that are significantly different from zero on any day of the week, in both the trading as well as the non-trading period.

Even though the descriptive analysis does tell us about the presence of excess returns on a few days in the spot index market and its absence in the index futures market, we need to carry out more robust tests to check if the returns on each day are significantly different from each other. In the next section, we do a regression analysis using dummy variables to check for the day of the week effect. We also test if the variances are different in the trading and the non-trading periods for the assets under consideration.

Table 5: Descriptive Statistics of Daily Price Changes on CNX Nifty Futures for the period 2003-2008

Panel A: Close-to-Close

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean	-2.73	2.45	2.06	-0.29	4.35	1.19
SD	78.88	60.13	62.37	60.04	68.69	66.03
T-stat	-0.57	0.69	0.56	-0.08	1.06	0.68

Panel B: Close-to-Open

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean	1.9	-0.37	2.27	1.9	0.58	1.25
SD	40.24	32.11	41.44	35	36.53	37.17
T-stat	0.78	-0.2	0.94	0.91	0.27	1.27

Panel C: Open-to-Close

	Mon	Tue	Wed	Thu	Fri	All days
N	274	288	291	281	278	1412
Mean	-4.64	2.82	-0.21	-2.18	3.76	-0.06
SD	63.6	53.86	55	55.31	59.93	57.42
T-stat	-1.21	0.89	-0.07	-0.66	1.05	-0.04

5 Results and Analysis

Table 6 shows the results for the day of the week effect in the Indian spot index market. Close-to-open weekend returns are significantly different from other days of the week. We do not find similar behavior in case of open-to-close returns, thus confirming the presence of weekend effect in the Indian stock market. This also points out to the relatively higher release of information over the weekend than over the week. The results support the calendar time hypothesis which states that the weekend returns should be greater than the returns on the other days of the week, as weekend returns are returns over a three calendar day period. Though, it should be noted that we find significant positive returns on Monday only during the non-trading period. During the trading period, the returns are negative but insignificant.

Table 6: F-Tests of the Hypothesis that b_i's=0 (Log Price change) for stock markets $R_t = a + b_1 D_1 + b_2 D_2 + b_3 D_3 + b_4 D_4 + e_t$

Panel A: Close-to-Close

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient*10^{-3}	-0.13	1.1	0.65	0.62	1.75	0.38
T-stat	-0.13	0.73	0.44	0.41	1.17	

Panel B: Close-to-Open

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient*10^{-3}	0.23	0.06	-0.05	-0.07	-0.02	0.31
T-stat	2.48*	0.67	0.68	0.56	0.86	

*Significant at 0.05 level

Panel C: Open-to-Close

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient*10^{-3}	-0.37	1.02	0.71	0.69	1.77	0.37
T-stat	-0.35	0.69	0.48	0.47	1.19	

Table 7 tests for the difference in variances in the non-trading period as compared to the trading period. The results show that variances are consistently higher in the trading period as compared to the non-trading period.

Table 7: Variance during Non-Trading Versus Trading Periods for CNX Nifty Index for the period 2003-2008 (log difference of Prices)

(in 10^{-6})	Monday	Tuesday	Wednesday	Thursday	Friday	All days
Non Trading Period (Close-to-Open)	2.25	2.56	2.56	1.44	3.61	2.46
Trading Period (Open-to-Close)	422.71	264.06	249.64	270.27	358.72	309.76
F-Statistic**	186.82	103.51	94.09	188.13	103.14	125.33

**All are significant at 0.01 levels

Table 8 shows the results for the tests of weekend effect in the futures index market. We do not find any weekend effect in the futures market as the intercept are not significantly different from zero. We repeat our tests with the measure of return proposed by Dyl &Maberly (1986) for the futures market. The results are shown in Table 9. The results are similar and do not show the presence of any weekend effect. Our results are similar to those found by Cornell (1985) for the S&P 500 futures market and Chamberlain et. al. (1990) for the NYSE composite index futures.

Table 8: F-Tests Of the Hypothesis that b_i's=0 (Log price change) for CNX Nifty futures market $R_t = a + b_1 D_1 + b_2 D_2 + b_3 D_3 + b_4 D_4 + e_t$

Panel A: Close-to-Close

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient*10^{-3}	-0.18	1.26	0.95	0.58	1.64	0.31
T-stat	-0.16	0.79	0.6	0.37	1.02	

Panel B: Close-to-Open

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient*10^{-3}	-0.99	1.92	0.92	0.86	2.51	0.93
T-stat	-0.97	1.34	0.64	0.6	1.74	

Panel C: Open-to-Close

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient*10^{-3}	0.81	-0.66	0.03	-0.27	-0.86	0.53
T-stat	1.45	-0.85	0.04	-0.35	-1.1	

Table 9: F-Tests Of the Hypothesis that b_i's=0 (Price Change)

$$R_t = a + b_1 D_1 + b_2 D_2 + b_3 D_3 + b_4 D_4 + e_t$$

Panel A: Close-to-Close

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient	-2.36	4.81	4.43	2.07	6.71	0.44
T-stat	-0.6	0.87	0.8	0.37	1.2	

Panel B: Close-to-Open

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient	1.91	-2.28	0.37	-0.01	-1.32	0.26
T-stat	0.87	-0.74	0.12	-0.003	-0.42	

Panel C: Open-to-Close

	Intercept	Tue	Wed	Thu	Fri	F-stat
Coefficient	-4.27	7.09	4.06	2.09	8.04	0.97
T-stat	-1.25	1.48	0.85	0.43	1.66	

Table 10 and Table 11 shows the results of tests for difference in variances in the non-trading and trading period for both the log measure of returns as well the as the price changes. In both cases we find the variances to be significantly higher in the trading period as compared to the non-trading period. This result is in line with the results of the spot market.

Table 10: Variance during Non-Trading Versus Trading Periods for CNX Nifty Futures for the period 2003-2008 (log difference of Prices)

(in 10^{-6})	Monday	Tuesday	Wednesday	Thursday	Friday	All days
Non Trading Period (Close-to-Open)	96.04	75.69	90.25	88.36	82.81	86.49
Trading Period (Open-to-Close)	374.42	244.92	252.81	257.60	346.70	292.41
F-Statistic**	3.87	3.23	2.77	2.87	4.14	3.37

**All are significant at 0.01 levels

Table 11: Variance during Non-Trading Versus Trading Periods for CNX Nifty Futures for the period 2003-2008 (Price change)

	Monday	Tuesday	Wednesday	Thursday	Friday	All days
Non Trading Period (Close-to-Open)	1619.26	1031.05	1717.27	1225.00	1334.44	1373.44
Trading Period (Open-to-Close)	4044.96	2900.90	3025.00	3059.20	3591.60	3297.06
F-Statistic**	2.50	2.81	1.76	2.50	2.69	2.40

**All are significant at 0.01 levels

6 Summary and Conclusion

Thus in conclusion though we find weekend effect in the spot index market, we do not find similar effect in the futures market. Also we find the day of the week returns for the non-trading period to be different from zero in the spot market but do not find similar effect in the futures market. Our results are different from the previous studies done in the context of Indian spot index. This could be due to the fact that none of the previous studies decomposed the returns into trading and non-trading periods. The results could also be different due to the difference in period under study and the difference in methodology used.

To the best of our knowledge, this is the first paper to throw light on the day of the week effect in the futures index market. Our results are consistent with the findings of few other papers that conclude that futures markets do not exhibit day of the week effects. Our results show that the index futures market in India is more efficient when compared to the underlying spot market.

As far as the variances are concerned we find the trading period variance to be significantly higher than the non-trading period variances for both the spot and the futures markets. This is to be expected as the information flow during the trading period is expected to be much higher than in the non-trading period.

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Endnotes

[1] S&P prefix belongs to the US based Standard & Poor's Financial Information Services. CNX reflects the identities of the promoters of the index, namely CRISIL and NSE.

[2] Usually natural logarithm of price changes is a good approximation for percentage changes. This is used in place of percentage change on account of it having some desirable statistical properties.