International Journal of Soft Computing 8 (4): 252-260, 2013
ISSN: 1816-9503

Statistical Data Mining Approach with Asymmetric Conditionally Volatility Model in Financial Time Series Data

[1]V. Ilango, [2]R. Subramanian and [3]V. Vasudevan
[1]Department of Computer Applications,
New Horizon College of Engineering, 560103 Bangalore, India
[2]Department of Computer Science, Pondicherry University, Pondicherry, India
[3]Department of Information Technology, Kalasalingam University, Srivilliputtur, India

Abstract: The objective of this study is to investigate the possible existence and stability of the day of the week effect and measures the mean and conditional volatility in testing the degree of market efficiency in the BSE Sensitivity Index and S&P CNX Nifty Index over the period spanning from July 1, 1997 to March 31, 2012 by using asymmetric TGARCH Model and introduced dummy variables into the mean equation and conditional variance equation the assess the distributional properties between Monday to Friday. Unit Root test, Augmented Dickey Fuller (ADF) test, Phillips-Peron (PP) test, Ljung Box Q were applied. The result of the study indicates the return and volatility for both the index are scattered over a period of time. Apart from that the risk averse investors are willing to commit huge amount of transaction with higher risk appetite because the market digest the information and react immediately towards news shocks. Therefore, the seasonality changes and interexchange arbitrage opportunity in emerging markets makes the investors to create various trading strategies in both the market. Overall, the professionals market watchers who are aware of the daily return pattern should adjust the timing of their buying and selling to take advantage of the effect.

Key words: Returns, emerging markets, volatility, weekend anomaly, TGARCH

INTRODUCTION

The seasonal changes in security market returns have been extensively documented over many years. The randomness of stock returns has been a curious area of study for many academia, policy makers and researchers. The volatile movements of the stock prices have created a need to identify the cause and effect relationship between the volatile price movements and the stock return. For an investor, it is important to know not only the variations in asset returns but also the variances in returns. The Efficient Market Hypothesis (EMH) states that the stocks are priced in an efficient manner to reflect all available information about the intrinsic value of the security. The arbitrage transactions eliminate all the unexploited profit opportunities in an efficient market. The Weak form hypothesis requires that there are no consistent patterns in the stock prices and consequently the returns. This is mainly due to the fact that in an efficient market, information is priced out in such a way that no arbitrage possibilities in any pattern of prices would be possible. The high inflation as well as challenging expectations on the future inflation makes it even more complicated to analyse what determines the requires rate of return by the investors in the stock market.

The day of the week patterns present legitimate challenges to the Efficient Market Hypothesis. A notable anomaly in the daily stock returns is the Monday effect which suggests that stock returns are significantly lower or negative on Mondays and Fridays have above average returns relative to the other days of the week. Numerous explanations for the day of the week effect can be provided based on economic and market microstructure arguments. In the emerging markets the release of adverse information over the weekend, limited disclosure requirements, information asymmetry, thin trading, bid-ask spread biases, measurement errors in stock prices, dividend patterns, etc., breed anomalies in stock returns. It is critical to note that the emerging markets operate under a more uncertain and problematic environment when compared to the developed markets and in such emerging markets. The government is key player in determining investor's attitude towards the stock markets either through its economic or political activities. The human behaviour of disclosing news having positive impact on the week days and waiting for the weekend to disclose the news with negative impact so as to allow the market to absorb the shock on weekends is the prime cause for the day of the week effect. The greater robustness of the effects in the European markets vis a vis US markets and markets in other regions of the

Corresponding Author: V. Ilango, Department of Computer Applications, New Horizon College of Engineering, 560103 Bangalore, India

world suggest a need for greater scrutiny of emerging markets. This study examines the possible existence and stability of the day of the week effect on both the mean and conditional volatility for the degree of market efficiency. Since, the emerging economies have been experiencing unstable financial environment and high inflation, risk-free rates and inflation have to be considered in the analysis. The market return variability is to be examined after studying the excess returns over inflation and risk-free rate. The results are that the newly emerging markets are structurally predisposed to market inefficiency or daily return anomalies. Therefore, this investigation of return and volatility patterns is extremely critical in identifying the impact on market returns. As more empirical evidences are obtained from different stock markets around the world, the puzzle still remains a mystery. One of the main limitations of the earlier analyses on the weekend anomaly is that they are all performed on developed and developing stock markets where one market will have an impact on another markets. While the results from the study are statistically significant, the economic significance is dubious. Meanwhile, the results from emerging market will explains the overall changes, asymmetric volatility behaviour and shocks to innovations in both the market are alone considered for the study. Furthermore, the other key determining macro economic variables and global effects are not been discussed in this research. Apart from that the study also helps the market participants in that it shows that they need to allow for distinct weekend patterns when using yield spreads. The studies on emerging security markets have been sparse quantitatively because the world capital markets have been integrated and developed in recent years. Therefore, the empirical results from emerging market are of great importance for the increasing group of people who are planning to operate in the national and international capital markets in the future. In spite of these limitations, it is hoped that the findings will be applicable to identify the status for developing markets.

Theoretical framework of efficient market hypothesis: The primary hypothesis for EMH is that stock prices react accurately and quickly reflect all available information in such a way that no one can earn abnormal return. The time for adjustment of any new information is considered as a critical factor; if the market adjusts more rapidly and accurately, it is considered more efficient. Dyckman and Morse (1986) state a security market is generally defined as efficient if the price of the security traded in the market act as though they fully reflect all available information and these prices react instantly and in unbiased fashion to new information. The alternative hypothesis is that security market is inefficient and the results of stock price will not accurately reflect the available new information. This might result from the following:

- The investor is unable to interpret the new information correctly
- The investors have no access to the new information
- The transaction cost in trading security is an obstruction for free trading; the restriction on short sale
- The investors might be misled by the change in accounting principles

A large amount of empirical research on capital market efficiency began even before Fama (1970). By the early eighties, the near consensus among academics in finance that capital markets are efficient started to fade for two reasons. First, researchers found anomalies in stock returns. One anomaly was that firms with low P/E effect earn higher than normal returns. Researchers also found so-called January effect, holiday effect, turn of the month effect and days of the week effect. However, these anomalies could be due to misspecification of the models used and represent only an indirect attack on efficiency. A second kind of evidence was a more direct challenge to market efficiency. Shiller (1989) argued that the aggregate stock market has been much more volatile due to dividend changes. The remainder of the study is organized as follows.

Review literature: Over the last two decades there have been many anomalies documented about the behaviour of stock returns. One of the most prevalent anomalies appears to be a weekend effect where stocks display significantly lower returns over the period between Friday's close and Monday's close. According to standard economics theory, stock prices should follow a martingale process and returns should not exhibit systematic patterns (Samuelson, 1965; Leroy, 1973; Lucas, 1978). Cross (1973) studied the returns on the S&P 500 Index over the period of 1953 to 1970 and suggested that the mean return on Friday is higher than the mean return on Monday. French (1980) studied the S&P 500 index for the period from 1953 to 1977, revealed similar results. Gibbons and Hess (1981) found negative Monday returns for 30 stocks of Dow Jones Industrial Index. Keim and Stambaugh (1984) examined the weekend effect by using longer periods for diverse portfolios and confirmed with the findings of earlier studies. Board and Sutcliffe (1988), Kim (1988), Yadav and Pope (1992) and Mills and Coutts (1995) have confirmed the existence of this so-called weekend effect for various UK indices. Studies conducted in the US, European and

Asia-Pacific exchanges. Jaffe and Westerfield (1985) and Tong (2000) demonstrate that in most cases Monday's returns are significantly lower in some cases negative than returns of other trading days. Lakonishok and Smidt (1988) and Pettengill (1989) have all studied the holiday effect on US stocks. Moreover, various theories concerning the cause of anomalies have been proposed in the literature, the aim of this study is to contribute a debate by investigating the weekend effect, particularly the more pronounced ones. An attempt is made to offer the market efficiency centers on whether future returns are predictable.

In an effort to search for a satisfactory explanation for the weekend effect, a plethora of recent studies (Connolly, 1989, 1991; Lakanishok and Levi, 1982; Jaffe and Westerfield, 1985; Smirlock and Starks, 1986; Abraham and Ikenberry, 1994; Agrawal and Tandon, 1994). Earlier studies have reported that common stock returns on average are abnormally low on Mondays and abnormally high on Fridays. Jaffe and Westerfield (1985) and Agrawal and Tandon (1994) provide empirical evidence from the USA. Jaffe and Westerfield (1985) find similar results in Japanese, Canadian and Australian stock markets as well as in the USA. Agrawal and Tandon (1994) provide international evidence from stock markets in 18 countries in support of the day of the week effects. Kiymaz and Berument (2003) also considered the influence of public and provide information as well as unanticipated returns among the reasons for day of the week effects on market volatility. Bhattacharya *et al.* (2003) finds evidence in favor of significant positive returns on non-reporting Thursday and Friday. Apolinario *et al.* (2006) used the GARCH and T-GARCH Models to examine 13 European stock markets and revealed a normal behavior of returns is present in these markets. Marrett and Worthington (2008) examined by regression analysis on a data covering the period from 9 September, 1996 to 10 November, 2006 for Australian stock market and their findings showed no seasonality for the overall stock market. Baker *et al.* (2008) studies the conditional volatility on the S&P/TSX Canadian returns index and found that the day of the week effect is sensitive in both the mean and the conditional volatility. Agathee (2008) found the stock exchange of Mauritius exhibited support of this phenomenon and returns were higher on Friday. However, the mean returns of the 5 week days were jointly insignificant and differ from zero. Testing the Russian stock market using ARCH/GARCH Models, McGowan and Ibrihim (2009) found a presence of the day of the week effect and concluded that returns were the positive in everyday except on Wednesday where they were the lowest; the highest returns were observed on Friday. Sutheebanjard and Premchaiswadi (2010) concluded that the Stock Exchange of Thailand (SET) showed a significant evidence of the day of the week effect where Monday and Friday found to have the highest and lowest percent of prediction error, respectively. Plethora of research studies available at national level to check the day of the week effect by introducing dummy variable. The studies conducted by Chaudhury (1991), Poshakwale (1996), Goswami and Anshuman (2000), Bhattacharya *et al.* (2003), Sarkar and Mukhopadhyay (2003), Amanulla and Thiripalraiu (2001) and Sarma (2004) confirmed the presence of day of the week effect in the Indian stock market. Nath and Dalvi (2005) evidenced 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. Bodla and Jindal (2006) studied Indian and US market and found evidence of seasonality. Raj and Kumari (2006) examined the weekend effect for both the stock exchange and suggested that the returns are negative on Tuesday and Monday found to be higher compared to the returns of other days. Choudhary and Choudhary (2008) and Chaudhary (1991) analyzed for global stock markets by using parametric and non-parametric tests. The result reported that out of twenty, eighteen markets showed significant positive return on various days other than Monday. To the knowledge, there has been no studies have investigated to explore the day of the week effect by introducing the dummy variable in mean equation and the conditional variance equation. This is unfortunate given the importance of to the economies. Despite, the obvious importance of exploring the day of the week effect is a paucity of research on this topic in emerging markets. The contribution of this study is to fill the existing gaps by using Asymmetric TGARCH (1,1) Model.

MATERIALS AND METHODS

This study investigates the day of the week effect and conditional volatility in Indian stock market by considering BSE Sensex (Bombay Stock Exchange Sensitivity Index) and NSE (National Stock Exchange) S&P CNX Nifty for the period from 1st July, 1997 to 31st March, 2012 with a total observation of 3,697 excluding public holidays. The data consists of the daily stock return for BSE Sensex and S&P CNX Nifty from the National Stock Exchange and the contract specifications and trading details are available from their website. Apart from NSE website, researchers retrieved the data for BSE Sensex from Centre for Monitoring Indian Economy (CMIE) database, respectively. The BSE Sensex consists of 30 component companies which represent some of the largest financially sound and most actively traded stocks of various industrial sectors and measures the pulse of the Indian domestic market. The

S&P CNX Nifty is a well diversified stock index comprises of 50 most liquid stocks accounting for 23 sectors of the economy. The S&P CNX Nifty is owned and managed by India Index Services and products Limited (IISL) which is a joint venture of NSE and CRISIL. The closing price indices were converted to daily compounded return by taking the log difference as R_t = log (P_t/P_{t-1}) where P_t represents the value of index at time t. All the observations are transformed into natural logarithms so that the price changes in returns prevent the non-stationary of the price level series approximate the price volatility.

Unit root test: Before estimating GARCH (1, 1) Model, the first step in time-series data is to determine the order of integration for each return series using Augmented Dickey Fuller test and Phillips and Perron test. Since, most of the time series have unit roots as many studies indicated including Nelson and Plosser and Stock and Watson suggest that the time series are non-stationary, the conventional regression techniques based on non-stationary time series produce spurious regression Granger and Newbold. The market return series should be examined for I(1) first. Hence, the Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test are employed to infer the stationarity of the series.

Augmented Dickey Fuller (ADF) test: The Augmented Dickey Fuller implicitly assumes that the estimated errors are statistically independent and homoscedastic. Heteroskedasticity does not affect a wide range of unit root test statistics. However, a problem will occur if the estimated residual ε_t is not free from autocorrelation since, this invalidates the test. The well-known example of unit root non-stationary is the Random Walk Model. There might be three possibilites for any time sereis. The time series might be a random walk, a random walk with drift or random walk with drift and time trend. The possible forms of the ADF test are given by the following equation:

$$\Delta Y_t = \gamma_1 y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + \varepsilon_t \quad (1)$$

$$\Delta Y_t = \alpha_0 + \gamma_1 y_{t-1} + a_2 t + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + \varepsilon_t \quad (2)$$

where, ε_t is white noise. The additional lagged difference terms are being determined by minimum number of residuals free from autocorrelation. This could be tested for in the standard way such as Akaike Information Criterion (AIC) or Schwartz Bayesian Criterion (SIC) or more usefully by the lag length criteria of the white noise series. The tests are based on the null hypothesis (H_0): Y_t is not I(0). If the calculated ADF test statistics are less than their critical values from table then the null hypothesis (H_0) is accepted and the series are non-stationary or integrated to zero order.

Phillips-Peron (PP) test: The distribution theory supporting the Dickey-Fuller tests is based on the assumptions that the error terms are statistically independent and have a constant variance. Thus while using the ADF methodology one has to make sure that the error terms are uncorrelated and that they really have a constant variance. The Phillips and Perron developed a generalization of the ADF test procedure that allows for fairly mild assumptions concerning the distribution of errors. The PP regression equations are as follows:

$$\Delta Y_{t-1} = \alpha_0 + \gamma_{yt-1} + \varepsilon_t \quad (3)$$

where, the ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right-hand side, the PP test makes a correction to the t statistic of the coefficient γ from AR(1) regression to account for the serial correlation in ε_t. The statistics are all used to test hypothesis $\gamma = 0$, i.e., there exists a unit root. So, the PP statistics are just modifications of the ADF t statistics that take into account the less restrictive nature of the error process.

Threshold Generalized Autoregressive Conditional Heteroscedasticity Model: The Autoregressive Conditional Heteroskedasticity (ARCH) Model is the most extensively used time-series models in the finance literature (Engle and Ng, 1993). The ARCH Model suggests that the variance of residuals at time t depends on the squared error terms from past periods. The residual term ε_{it} is conditionally normally distributed and serially uncorrelated. The strength of the ARCH technique is that it uses the established and well specified models for economic variables; the conditional mean and conditional variance are the only two main specifications. A useful generalization of this model is the GARCH parameterization. Bollerslev extended Engle's ARCH Model to the GARCH Model and it is based on the assumption that forecasts of time varying variance depend on the lagged variance of the asset. The GARCH Model specification is found to be more appropriate than the Standard Statistical Models because it is consistent with return distribution which is leptokurtic and it allows long-run memory in the variance of the conditional return distributions. As a result, the unexpected increase or decrease in returns at time t will generate an increase in the expected variability in the next period.

In TGARCH Model, it has been observed that positive and negative shocks of equal magnitude have a different impact on stock market volatility which may be attributed to a leverage effect (Black, 1976). In the same sense, negative shocks are followed by higher volatility than positive shocks of the same magnitude (Engle and Ng, 1993). The threshold GARCH Model was introduced by Zakoian (1994) and Glosten *et al*. (1993). The main target of this model is to capture asymmetry in terms of negative and positive shocks and adds multiplicative dummy variable to check whether there is statistically significant difference when shocks are positive and negative. The conditional variance for the simple TGARCH Model is defined by:

$$R_t = C_0 + R_{1t-1} + \alpha_2 D_{Tu} + \alpha_3 D_{We} + \alpha_4 D_{Th} + \alpha_5 D_{Fr} + \lambda_6 \sqrt{h_t} + u_t \quad (4)$$

$$\varepsilon_t \backslash I_{t-1} N(0, h_t) \quad (5)$$

$$h_t = C_0 + \sum_{i=1}^{p} \beta_i h_{t-1} + \sum_{j=1}^{q} \alpha_j u_{t-j}^2 + \psi d u_{t-1}^2 + \alpha D_{Tu} + \alpha D_{We} + \alpha D_{Th} + \alpha D_{Fr} + u_t \quad (6)$$

where, R_t denotes the realized returns for BSE Sensitivity Index and S&P CNX Nifty Index at time t. The h_t refers the conditional volatility of the series which is proxies by R_{t-1}, α, β, ψ and γ are the coefficients to be estimated. The lagged return for both the index was indicated with R_{t-1} while the (α) dummy coefficient like Tuesday, Wednesday, Thursday and Friday were included in the mean equation to identify the return over the period. The risk premium indicates that the risk averse agent would be willing to accept higher risks. But, if the λ value is statistically significant indicate the market momentum is positive and the investors are willing to commit transaction to a higher risk. The α scaling parameter h_t now depends both on past values of the information which is captured by the lagged squared residual terms and on past values of itself which are captured by lagged h_t terms. The β parameter refers to the last periods forecast variance, the larger coefficients value was characterized by the informational effects to conditional variance that take a long time to die out. Apart from that the dummy variables from Tuesday, Wednesday, Thursday and Friday was included to measure the market volatility and persistent of information towards market shocks over the period of time. Finally, the ψ_t takes the value of 1 if ε_t is negative and 0 otherwise, identifying good news and bad news have a different impact.

RESULTS AND DISCUSSION

Table 1 shows the descriptive statistics for BSE and NSE return series for the period from July 1, 1997 to March 31, 2012. The statistics reported are the mean, standard deviation, skewness, kurtosis and Jarque-Bera test statistics. The observations of result shows that average daily returns were higher for BSE and NSE on Wednesday and Thursday, respectively. In comparing the market volatility with BSE and NSE, the market was highly volatile on Friday and Monday. The distribution of returns is positively skewed with a heavier tail to the right on Monday. But, the same is not observed on Wednesday and Thursday. Overall, the skewness value should be close to zero, indicating that the return series exhibit a symmetrical distribution while the skewness observed with asymmetrical effect. The value of kurtosis for both the exchanges was observed to be very large and leptokurtic in nature. The Bera and Jarque (1980) test used to measure the normality of the series. The result of Jarque and Bera test suggest that much of the non-normality is due to the special characteristics, might be due to volatility clustering, leptokurtosis and asymmetry effects associated with more advanced futures markets.

The Ljung-Box test is a statistical measure used to check whether any group of autocorrelations of a time series for both NSE and BSE for the normalized residual at lag 5-20 and their results are shown in Table 2. Instead of testing randomness at each distinct lag, it tests the overall randomness based on a number of lags. The result of Ljung-Box statistic indicates serial correlation in the standardized residuals has no serial correlation in the squared standardized residuals. Apart from this, the result also observed that the lagged values are significant at different levels and indicate the rejection of null hypothesis of no autocorrelation up to order 20 lags. Overall, the study suggests that the GARCH (1,1) Model is an adequate description of the volatility process of both the indices and no higher lags are needed to capture the autocorrelation. In the recent finance research, the

Table 1: Summary statistics for NSE and BSE returns series

Particulars	Index	Monday	Tuesday	Wednesday	Thursday	Friday
Mean	NSE	0.0553	0.0821	0.0507	0.1291	0.0169
	BSE	0.0498	0.0369	0.1131	0.0476	0.0836
SD	NSE	1.5246	1.5483	1.6067	1.7428	1.9779
	BSE	1.9535	1.5285	1.5831	1.4953	1.8292
Skewness	NSE	0.0680	-0.072	-0.2922	-1.1287	0.0182
	BSE	0.2951	0.0255	-0.1003	-0.2938	-0.694
Kurtosis	NSE	7.1044	5.4144	5.6257	10.865	16.964
	BSE	15.147	6.7542	5.5102	5.5090	8.0870
JB test	NSE	351.36	121.40	150.75	1392.3	3965.0
	BSE	3068.8	291.33	131.85	137.51	565.40

SD refers to Standard Deviation; JB test indicate Jarque Bera test statistics

Table 2: Ljung box Q-Statistics for BSE and NSE returns

Index	LB (5)	LB (10)	LB (15)	LB (20)
NSE	21.719	38.534	52.062	65.738
BSE	23.429	41.371	50.708	58.752

Ljung Box (5), (10), (15) and (20) refers to 5, 10, 15 and 20 lags, respectively

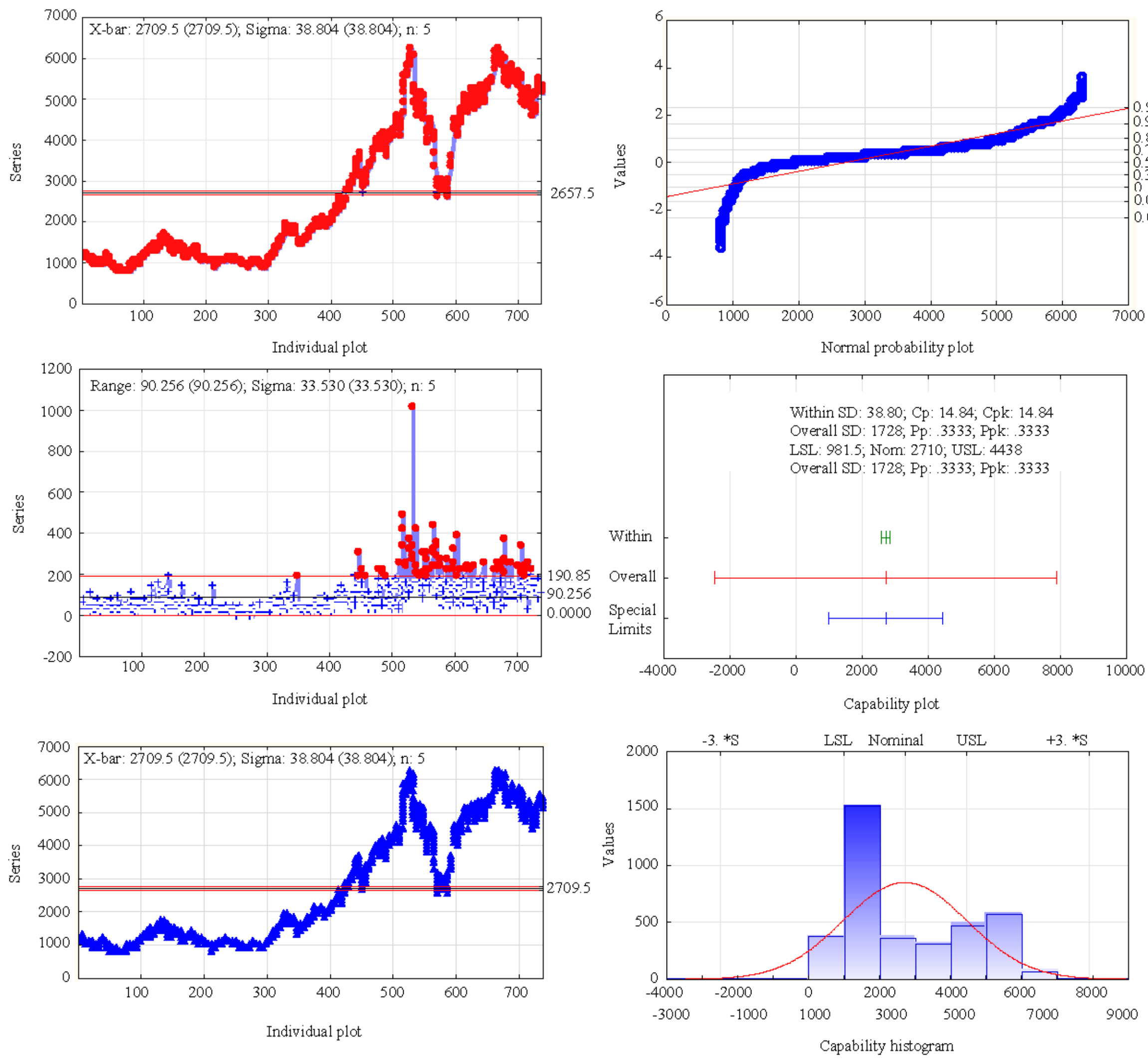

Fig. 1: NSE return series compound graph

explosion for testing the stationarity of the time series data is first attempted and testing the presence of unit root in the variables is considered first, otherwise the analysis is believed to produce spurious regression results. The return for BSE and NSE series was examined for I(1) which was carried out in two steps process in Table 3 by conducting the unit root test using both the Augmented Dickey Fuller (ADF) test and Phillip-Peron (PP) test on the first differences for the return series. The unit root test results identifies that the return series are found to be stationary at first-order difference and integrated at the order of I(1). To capture the asymmetries in terms of positive and negative shocks TGARCH (1, 1) Model was envisaged in Table 4. This table reports the results of introducing dummy variable into the mean equation and conditional variance equation. The Ljung Box statistics and ARCH-LM test also used for the

Table 3: Unit root test for BSE and NSE returns

	Augmented Dickey Fuller test		Phillip Perron test	
Index	Constant	Constant and Trend	Constant	Constant and Trend
NSE	-22.4389	-22.4436	-46.3868	-46.3825
BSE	-22.7451	-22.7496	-46.0366	-46.0322

ADF is the Augmented Dickey Fuller test and PP refers to Phillips-Perron test; one-sided p-values

squared residual series to identify the best fitted model. In the mean equation, the lagged return was significant for both the exchanges at 1%. The dummy coefficient for Tuesday, Wednesday, Thursday and Friday for both the exchanges were insignificant in nature. The risk premium (λ) for the exchanges was 0.0147 and 0.0232 with statistically insignificant and significant for BSE and NSE, respectively. The risk premium indicates that the risk averse agent would be willing to accept higher risks. But if the λ value is statistically significant indicate the market momentum is positive and the investors are willing to commit transaction to a higher risk. In the variance equation, the size of the parameters ARCH (α) and GARCH (β) determine the short-run dynamics of the resulting volatility of the time series. The GARCH effect for BSE and NSE was statistically significant with 0.6575 and 0.8048, respectively. The large coefficient indicates that shocks to conditional volatility takes a long time to die out and hence volatility in the market in persistent. Hence, the market will take some time to digest the information fully into the prices. On the other hand, the ARCH coefficient indicates the volatility reacts quite intensely to market movements resulting in spike volatility. The asymmetric news capture by (ψ) was statistically significant at 1% level for both the market. Therefore, the good news plays a significant role in Indian markets. The introduction of dummy variable was statistically significant at 1 and 5% level, respectively on Wednesday and Friday. In NSE, all the days were insignificant except Tuesday which means the volatility was high on Tuesday. The results of Ljung Box Q statistics for normalized squared residuals upto 15 lag could not reject the null hypothesis of no autocorrelation. Apart from that the result of ARCH-LM test also significant variables is correctly specified upto 15 lag. The findings of ARCH-LM test also indicate that the squared standardized residual terms have constant variances and do not exhibit autocorrelation. Figure 1 and 2 shows the compound difference between NSE and BSE return series.

Table 4: TGARCH Model for weekend effect for return and volatility

Particulars	BSE	NSE
Mean equation		
C	0.0311 (0.2553)	-0.0112 (0.0861)
R_{t-1}	0.1655 (3.1747)[a]	0.1379 (2.54626)[a]
αD_{Tu}	-0.120 (-0.6892)	-0.0158 (0.0818)
αD_{We}	-0.0768 (-0.476)	0.1405 (0.77675)
αD_{Th}	0.1073 (0.6513)	-0.0842 (-0.4836)
αD_{Fr}	-0.0789 (-0.477)	-0.0197 (-0.1228)
γ	0.0147 (0.4128)	0.0232 (2.616940)[a]
Variance equation		
C	0.3003 (6.3809)[a]	0.8068 (4.3279)[a]
α	0.0539 (1.4571)	0.1268 (4.3279)[a]
β	0.6575 (25.972)[a]	0.8048 (3.3731)[a]
Ψ	0.2726 (3.6378)[a]	0.2970 (2.6921)[a]
αTuesday	0.0135 (0.2722)	-0.2240 (-5.164)[a]
αWednesday	-0.0834 (-2.705)[a]	0.0481 (1.3977)
αThursday	-0.0095 (-0.278)	-0.0342 (-0.611)
αFriday	0.0570 (2.1363)[b]	0.0288 (0.6600)
Squared residuals		
Ljung box (5)	11.301 (0.046)	6.0521 (0.301)
Ljung box (10)	16.878 (0.077)	6.9481 (0.730)
Ljung box (15)	19.609 (0.187)	15.365 (0.425)
ARCH-LM test		
ARCH-LM (5)	0.0736 (0.1154)	0.0462 (0.9922)
ARCH-LM (10)	0.0095 (0.8387)	0.0170 (0.3660)
ARCH-LM (15)	0.0097 (0.8342)	-0.0294 (-0.631)

Ljung kox statistics >15 lag; [ab]Indicate statistically significant at 1 and 5%, respectively

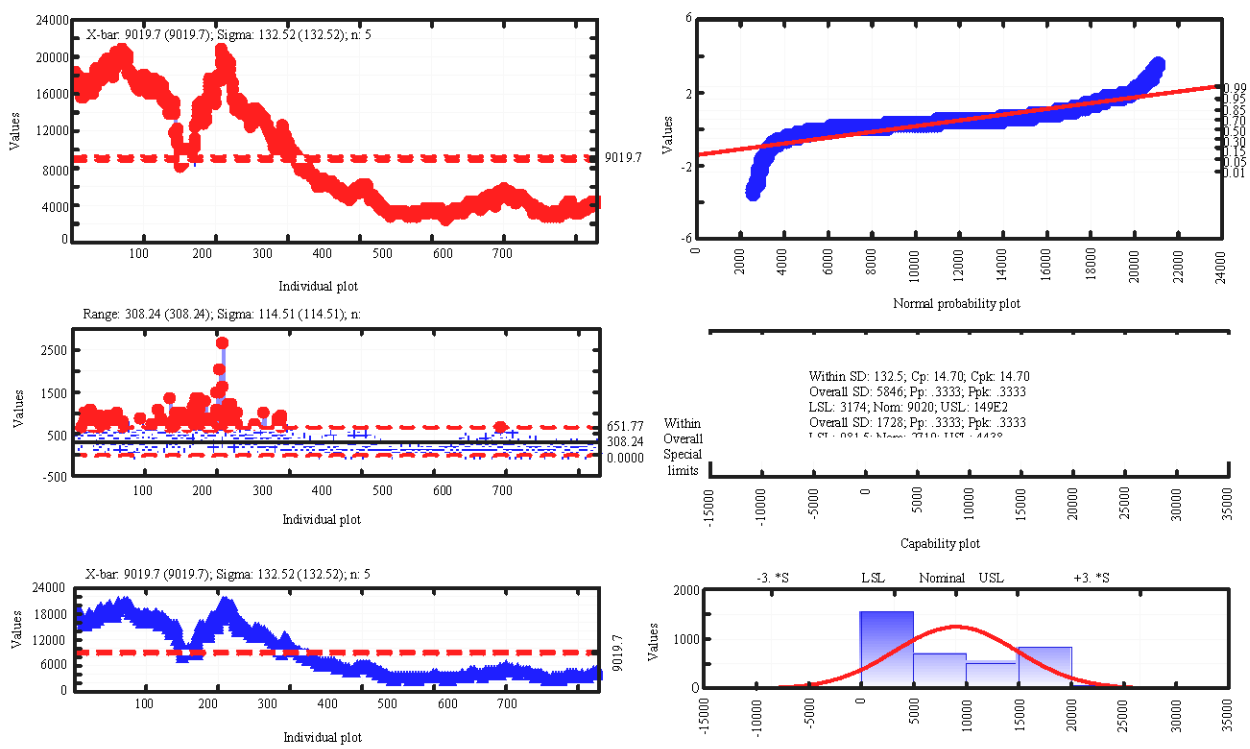

Fig. 2: BSE return series compound graph

CONCLUSION

In the literature, the weekend anomaly is studied extensively in both equity and non-equity markets. The volatility pattern in stock market returns might enable investors to take advantage of relatively regular shifts in the markets by designing various trading strategies in predicting the pattern of the market movements. The main purpose of this study is to investigate the possible existence and stability of the day of the week effect on both the mean and conditional volatility for the degree of market efficiency for the period from July 1, 1997 to March 31, 2012. Researchers examined by using the Asymmetric GARCH Model to test whether inferences drawn from statistical test are robust in nature. The result of the study indicates that the lagged return in both the market were statistically significant at 1% level. The risk premium in both the exchanges is positive. But the NSE was highly significant at 0.0232 with 1% level. So, the risk averse agents are willing to commit maximum transactions to higher risk. In the conditional volatility, the ψ coefficient was significant at 0.2726 and 0.2970 and it is clearly suggested that good news plays a crucial role in both the stock exchanges. The inclusion of dummy variable in the variance equation indicates that market was significant on Wednesday and Friday in BSE. On the other, the estimated coefficient for all the days was insignificant trend except Tuesday. In comparing both the markets, it is clearly evidenced that the investors can't predict the markets; it is mainly due to the integration in the global market make fluctuations in the domestic markets and hampered the growth of investors. Apart from that the technological changes make the investors to create various strategies in betting the market with a positive end. Therefore, the seasonality in emerging market creates arbitrage opportunities to the market participants by using yield spreads due to the effect of different period account settlement, investor sentiment and unsystematic risk in the market. Overall, the information flow during the trading period is expected to be much higher than in the non-trading period. The impact of institutional factors in both the markets is left to the future research agenda.

REFERENCES

Abraham, A. and D.L. Ikenberry, 1994. The individual investor and the weekend effect. J. Financial Quant. Anal., 29: 263-277.

Agathee, U.S., 2008. Day of the week effects: Evidence from the stock exchange of mauritius (SEM). Int. Res. J. Finance Econ., 17: 7-14.

Agrawal, A. and K. Tandon, 1994. Anomalies or illusions: Evidence from stock markets in eighteen countries. J. Int. Money Finance, 13: 83-106.

Amanulla, S. and M. Thiripalraiu, 2001. Week end effect: New evidence from the Indian stock market. Vikalpa, 26: 33-50.

Apolinario, R.M.C., O.M. Santana, L.J. Sales and A.R. Caro, 2006. Day of the week effect on european stock markets. Int. Res. J. Finance Econ., 2: 53-70.

Baker, H.K., A. Rahman and S. Saadi, 2008. The day-of-the-week effect and conditional volatility: Sensitivity of error distributional assumptions. Rev. Financial Econ., 17: 280-295.

Bera, A.K. and C.M. Jarque, 1980. Efficient tests for normality, homoscedasticity and serial independence of regression residuals. Econ. Lett., 6: 255-259.

Bhattacharya, K., N. Sarkar and D. Mukhopadhyay, 2003. Stability of the day of the week effect return and volatility at the Indian capital market: A GARCH approach with proper specification. Applied Financial Econ., 13: 553-563.

Black, F., 1976. Studies of stock market volatility changes proceedings of the american statistical association. Bus. Econo. Stud. Section, 70: 177-181.

Board, J.L.G. and C.M.S. Sutcliffe, 1988. The weekend effect in UK stock market returns. J. Bus. Finance Account., 15: 199-213.

Bodla, B.S.and K. Jindal, 2006. Seasonal anomalies in stock returns: Evidence from India and the US. Decision, 33: 163-178.

Chaudhury, S.K., 1991. Seasonality in share returns: Preliminary evidence on day of the week effect. Chartered Accountant, 40: 407-409.

Choudhary, K. and S. Choudhary, 2008. Day-of-the-week effect: Further empirical evidence. Asia-Pacific Bus. Rev., 4: 67-74.

Connolly, R.A., 1989. An examination of the robustness of the weekend effect. J. Financial Quantitative Anal., 24: 133-169.

Connolly, R.A., 1991. A posterior odds analysis of the weekend effect. J. Econ., 49: 51-104.

Cross, F., 1973. The behavior of stock prices on fridays and mondays. Financial Anal. J., 29: 67-69.

Dyckman, T.R. and D. Morse, 1986. Efficient Capital Markets and Accounting: A Critical Analysis. Prentice Hall, United States.

Engle, R.F. and V.K. Ng, 1993. Measuring and testing the impact of news on volatility. J. Finance, 48: 1749-1778.

Fama, E.F., 1970. Efficient capital markets: A review of theory and empirical work. J. Finance, 25: 383-417.

French, K.R., 1980. Stock returns and the weekend effect. J. Financial Econ., 8: 55-69.

Gibbons, M.R. and P. Hess, 1981. Day of the week effects and asset returns. J. Bus., 54: 579-596.

Glosten, L.R., R. Jagannathan and D.E. Runkle, 1993. On the relation between the expected value and the volatility of the nominal excess returns on stocks. J. Finance, 48: 1779-1801.

Goswami, R. and R. Anshuman, 2000. Day of the week effect on bombay stock exchange. ICFAI J. Applied Finance, 6: 31-46.

Jaffe, J. and R. Westerfield, 1985. The week-end effect in common stock returns: The international evidence. J. Finance, 40: 433-454.

Keim, D.B. and R.F. Stambaugh, 1984. A further investigation of weekend effects in stock returns. J. Finance, 39: 819-840.

Kim, Z.W., 1988. Capitalizing on the weekend effect. J. Portfolio Manage., 14: 59-63.

Kiymaz, H. and H. Berument, 2003. The day of the week effect on stock market volatility and volume: International evidence. Rev. Financial Econ., 12: 363-380.

Lakanishok, J. and M. Levi, 1982. Weekend effects in stock returns: A note. J. Finance, 37: 883-889.

Lakonishok, J. and S. Smidt, 1988. Are seasonal anomalies real? A ninety-year perspective. Rev. Financial Stud., 1: 403-425.

Leroy, S.F., 1973. Risk aversion and the martingale property of stock prices. Int. Econ. Rev., 14: 436-446.

Lucas, R.E., 1978. Asset prices in the exchange economy. Econometrica, 46: 1429-1445.

Marrett, G.E. and A.C. Worthington, 2008. The day-of-the-week effect in the ustralian stock market: An empirical note on the market industry and small cap effects. Int. J. Bus. Manage., 3: 3-8.

McGowan, Jr C.B. and I. Ibrihim, 2009. An analysis of the day-of-the-week effect in the Russian stock market. Int. Bus. Econ. Res. J., 8: 25-30.

Mills, T.C. and J.A. Coutts, 1995. Calendar effects in the london stock exchange FTSE indices. Eur. J. Finance, 1: 79-94.

Nath, G.C. and M. Dalvi, 2005. Day-of-the-week effect and market efficiency-evidence from indian equity market using high frequency data of national stock exchange. ICFAI J. Applied Finance, 11: 5-25.

Pettengill, G.N., 1989. Holiday closings and security returns. J. Financial Res., 12: 57-67.

Poshakwale, S., 1996. Evidence on weak form of efficiency and day of the week effect in the Indian stock market. Finance India, 10: 605-616.

Raj, M. and D. Kumari, 2006. Day-of-the-week and other market anomalies in the Indian stock market. Int. J. Emerg. Markets, 1: 235-246.

Samuelson, P.A., 1965. Proof that properly anticipated prices fluctuate randomly. Industrial Manage. Rev., 6: 41-50.

Sarma, S.N., 2004. Stock market seasonality in an emerging market. Vikalpa, 29: 35-41.

Shiller, R., 1989. Market volatility for stock market index and stock index futures. J. Futures Markets, 8: 115-121.

Smirlock. M. and L. Starks, 1986. Day-of-the-week and intraday effects in stock returns. J. Financial Econ., 17: 197-210.

Sutheebanjard, P. and W. Premchaiswadi, 2010. Analysis of calendar effects: Day-of-the-week effect on the stock exchange of Thailand (SET). Int. J. Trade Econ. Finance, 1: 57-62.

Tong, W.S., 2000. International evidence on weekend anomalies. J. Financial Res., 23: 495-522.

Zakoian, J.M., 1994. Threshold heteroskedastic models. J. Econ. Dyn. Control, 18: 931-955.

Yadav, P.K. and P.F. Pope, 1992. Intraweek and intraday seasonalities in stock market risk premia-cash and futures. J. Banking Finance, 16: 233-270.