Day of The Week Anomaly and Stock Returns Volatility at Nairobi Securities Exchange

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ABSTRACT

This study sought to investigate the effect of the day of the week anomaly on the stock market returns volatility on the performance of Nairobi Securities Exchange. The study sampled NSE - 20 share index closing prices from September 2000 to December 2019. Data was obtained from the Nairobi Securities Exchange database. Stata version 12 software was used and descriptive statistics to analyse the data using the EGARCH (1, 1) model. The mean analysis results showed the presence of the day of the week effect on the stock market returns of the NSE 20 Share Index at the Nairobi Securities Exchange. This implies that Nairobi Security Exchange performance still contravenes the Efficient Market Hypothesis Theory since investors can use the day of the week anomalies to make abnormal return. The variance analysis showed a positive asymmetric term, implying that positive shocks have greater impact on volatility more than negative shocks of the same magnitude. Positive information in the stock market generates less variance or volatility in the market since positive return translates to high equity prices. This implies that volatility tends to decrease when the stock market returns at the NSE increases than when the stock market decreases with the same amount.

Keywords: Day of the week anomaly, efficient market hypothesis, and stock market returns volatility.

1 Introduction

Eugene Fama formulated the Efficient Market Hypothesis in 1970. He described efficient security market as a market where prices fully reflect all available information both historical, past, present and insider [1]. However, according to [2], inefficient markets exist hence seasonal market anomalies, such as the day of the week effects, turn of the month effect, holiday effect, pre-holiday effect, weekend effect among other anomalies. These anomalies are referred to as calendar anomalies or seasonal anomalies.

[3] asserted that the day of the week anomaly exist in the stock market and he referred to it as the presence of a pattern on the stock returns whereby the higher returns are associated with a particular day of the week. On the other hand, [4] define the holiday effect anomaly as the period when the stock returns are significantly higher before holidays than operational days. On the other hand, [5] asserted that month of the year is the time when the stock price increase or decrease from month to month in one trading year in a financial market or the difference in monthly returns in each month of the year. Also, [2] refers the turn of the month effect as the

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pattern where the stock values go up on the last day of each trading month with the prices continuing for the first three trading days of the next month.

On the same note, [2] explained that volatility in stock prices are as a result of the calendar effect. Price shocks are an indispensable piece of the securities exchange. The progression of news is persistent and essentially boundless, and occasionally some of them might be persuasive for a given stock market [5].

The presence of anomalies in the stock market has remained a question of concern for investors as the concept of Fama's EMH was accepted by many researchers for a long time [3]. This also explains why security price anomalies have attracted a lot of researchers over the years [6]. The question though remains as to why different researchers who have researched on the calendar anomalies end up getting different outcomes. Could it be the scope of the research or the methodology used in the analysis? This study therefore examined the effects of the seasonal anomalies; day of the week effect, turn of the month effect and holiday effect on stock market return using the EGARCH Model.

The NSE 20 Share Index was introduced in the market in 1964. It represents the price-weighted - index determined as a mean of the 20 best performing counters. The firms making up the NSE 20 Share Index had to meet the following criteria; the market capitalization, share traded, deals/liquidity and turnover during the period under review are weighed in the ration 4:3:2:1 respectively. The company must have at least 20% of its shares quoted at the NSE, must have a minimum capitalization of Kshs.20 million and company should be a blue chip with superior profitability and dividend record. NSE 20 share index go along with the NSE 25 Share Index (which looks at the top 25 performing firms) and the Nairobi All Share Index (which considers all the listed firms) as the indices as the bourse [7].

The study concentrated on the NSE 20 Share Index and spotlight on those Companies which were recorded under this classification. The Companies making up NSE 20 Share Index incorporate Banking Sector; Barclays Bank of Kenya Ltd, Diamond Trust Bank Ltd, Equity Group Holding PLC, KBC Group Plc, NIC Group Plc, Standard Chartered Bank Kenya Ltd and Co-operative Bank of Kenya Ltd. Commercial and Services Sector; Nation Media Group Plc, WPP Scan bunch Plc and Kenya Airways Plc. Construction and Allied Sector; Bamburi Cement Ltd .Energy and Petroleum Sector; KenGen Co. PLC, and Kenya Power and Lighting Co. Ltd. Insurance Sector; Britam Holding PLC and Kenya Re-Insurance Corporation Ltd; Investment Sector; Centum Investment Co. Investment Services Sector; Nairobi Securities Exchange PLC. Manufacturing and Allied Sector; British America Tobacco Kenya Plc; East Africa Breweries Ltd and the Telecommunication Sector; Safaricom Plc [7].

Despite NSE undertaking various measures to enhance security returns, the sector's performance is still below expectations as inefficiency is often experienced and investors and other market players are likely to benefit [8]. The presence of seasonal market anomalies has remained to be one of the biggest threats to market efficient concepts as they influence investors' returns when observed effectively [2]. However [9] observed that anomalies are often discovered in the security markets then they disappear once traders exploit them to earn excess returns.

Previous studies conducted both in developed and developing economies have continued to give conflicting results on the existence of seasonal anomalies in the stock markets. Most studied have contradicted EMH while others have alluded by it [5]. [10] Confirmed the existence of the holiday effect in Central and Eastern Europe, [11] confirmed calendar anomalies in Pakistan while [12] confirmed the day of the week and weekend effect in India Stock Market.

Studies done locally have given mixed findings, [13] examined the turn of the month effect using paired t-test and regression analysis and failed to confirm presence of turn of the month effect on stock return as the effect was very minimal. [14] investigated the day of the week effect using descriptive statistics and multiple regression analysis and concluded that day of the week effect exist in the NSE stock market. On the other hand [15] used regression analysis and confirmed presence of pre and post-holiday effects at NSE. [8] as well as [16] used t-test and ANOVA they confirmed presence day of the week effect, weekend effect and monthly effect

seasonal anomalies. These studies used OLS in their analysis; OLS is a homoscedastic model as it assumes constant volatility hence the results might be misleading to investors as they only capture the mean return but not the variance equation. [17] Also claims these approaches have limitation and other problems such as serial correlation and heteroscedasticity on the residual yields.

[6] Studied the effect of calendar anomalies on the stock returns volatility by comparing the OLS Model, GARCH (1, 1) and T-GARCH Model. The findings showed that the day of the week is statistically significant in both models with Friday having the highest returns and Monday lowest return. The January effect was explained in the OLS while GARCH (1, 1) did not show any presence of it.

From the review of the studies done locally, use of EGARCH has not been explored hence this study sort to provide new evidence on the effect of seasonal market anomalies on stock market return by using EGARCH (1,1). EGARCH model was introduced by [18] to handle financial time series data and particularly to allow for asymmetric effect such as the leverage effect, in which negative shocks have a greater effect on conditional volatility than positive shocks on the same magnitude. It is also ideal for volatility clustering for instant, when large (small) price changes tend to follow large (small) price changes. Investors can easily monitor the patterns to make informed investments decisions. The general objective of this study was to determine the effect of seasonal effect of day of the week anomaly on stock market return volatility on the performance of the Nairobi securities.

2 Literature Review

This section presents the empirical literature reviewed as per the study variables as well as the identification of gap and the operationalization of variables.

2.1 Day–of–the week effects and stock returns volatility at NSE

Many researchers have explored the day of the week effect both locally and internationally. In the Asia Market, [12] explored the presence of regularity in the Indian securities exchange. BSE Sensex list was picked for 10 years from 1st April 2000 to 31st March 2010. They looked at the day of the week and the monthly effect pattern. Methodologies used were descriptive statistics which include daily return, standard deviation, Skewness, Kurtosis, Kruskall-Wallis Test and Linear Regression Model. They discovered that day of the week and monthly effect designs didn't seem to exist in the Indian Stock Market during the period.

[19] Studied the day of the week effect on volatility majoring on the role of asymmetry. He explored the observational effect in five significant global records; France, Germany, United States, United Kingdom and Japan securities exchanges. GARCH Model was utilized to break down the information. The outcomes varied for each model utilized henceforth, they reasoned that the decision of a model ought to be considered as a factor that impacts the day of the week. He again likewise discovered that asymmetry doesn't impact the seasonal effect.

[20] Looked at the empirical investigation of the day of the week on stock returns and volatility from the Muscat Securities Market. GARCH (1, 1), TARCH and E-GARCH (1, 1) methodologies were utilised. The finding showed that there was no presence of the day of the week effect. GARCH (1, 1) suggested high persistence in conditional volatility of stock returns. He concluded that EARCH models did not show evidence of asymmetry in stock returns.

In Africa, [21] researched the day of the week impact on Johannesburg stock exchange indices between 1995 and 2016 utilizing GARCH Model. He discovered that there was the presence of the day week in both volatility and return equation. Better yields were seen on Monday and low profits for Friday while volatility supposedly appeared in all the exchanging days of the week.

[22] Researched the day of the week effect on securities exchange returns and unpredictability in Nigeria and South Africa over pre-advancement and post-progression periods. The paper

utilized the Exponential Generalized Autoregression Conditional Heteroscedasticity (EGARCH) model to appraise the day of the week impact both in the mean and fluctuation conditions [18]. The Post-progression period for the Nigerian value advertises uncovers the day of the week impact on Friday just in the mean condition. In the difference condition, there was proof of the day of the week impact on Tuesdays and Thursdays individually. In South Africa, there exist the day of the week impact on Mondays and Fridays during the pre-advancement period. There is proof of the day of the week impact on Thursdays in the mean condition and Fridays just in the change condition.

[23] Investigated the day of the week effect in West Africa Regional Stock Market between 1998 and 2007 using two stock indexes the Brvm-10 Index and Brvm-Composite Index. The study utilised the descriptive statistics in its data analysis. The investigation observed daily patterns exhibit lower daily mean and lower standard deviation. Lower daily mean was observed on Tuesdays and Wednesday and higher pattern observed on Thursdays and Fridays.

[24] examined the efficient market hypothesis and market anomalies; evidence from the day of the week effect of Malaysian Exchange for 8 years. He used the OLS model was adopted in the analysis. The market was divided into two subgroups because of the financial crisis experienced in the market within the periods. They concluded that the weekend effect was present in the Malaysian Market.

Locally, [25] examined the seasonality impact on securities exchange returns at the NSE. The target of his examination was to determine the presence of the day of the week effect and the month of the year effect on the NSE. The study adopted a descriptive and inferential research design in obtaining information. The NSE 20-share Index was selected to represent the overall daily stock prices. The investigation discovered that Friday had the least negative returns while Monday had the most elevated positive returns. The stock market returns at NSE were also established to be relatively higher in January. The study concluded that there was the presence of seasonality influence at NSE but its effects are minimal.

[26] Discussed the Monday effect on the stock returns at the Nairobi Securities Exchange. The logarithm mean of the stock average return of the NSE 20 Share Index was analysed. The study used descriptive statistics to determine the relationship between the variables. The findings confirmed the Monday Effect Theory. High stock prices were recorded on Friday and lowest on Mondays. [8] Looked into the seasonal effects on average returns of the Nairobi Securities Exchange. They analysed the nearness of the day of the week impact, end of the week impact and month to month effect anomalies. They utilized the t-test and ANOVA investigation model in the examination. The investigation gave proof of the presence of the seasonal effect in the NSE. [27] Researched the day of the week effect in the NSE. The primary target of the investigation was to look at the nearness of the day of the week impact in NSE. The analyst utilized a regression analysis. The discoveries affirmed the presence of the day of the week anomaly in the NSE 20 - Share index.

2.2 Causes of Seasonal Stock Market Anomalies

Various explanations have been given as to the causes of seasonal market anomalies by various researchers. In this section we discussed three of the possible causes which might have resulted to the day of the week anomaly and they include; measurement error, Information asymmetry, behavioral impact among others.

2.2.1 Measurement error

Previous studies conducted have argued that seasonal effects occurrence may be as a result of statistical tool and model applied. [17] Analyzed the robustness of the Day of the Week effect to alternative estimation and testing procedures. The outcome presented that the strength of the Day of the Week evidence appears to depend of the estimation and testing method used. [28] Argues that most of the empirical research done documented similar outcome as a result of data snooping from the previous studies done on financial anomalies.

[19] Studied the day of the week effect on volatility majoring on the role of asymmetry. The study explored the observational effect in five significant global records France, Germany, United States, United Kingdom and Japan securities exchanges. Outcomes varied for each model utilized henceforth, they reasoned that the decision of a model ought to be considered as a factor that impacts the day of the week.

2.2.2 Behavioural effect

Speculators and investors behaviour is believed to have contributed to the fall and rise of stock market returns. Empirical research has shown that when selecting a portfolio, investors not only consider statistical measures like risk and return but also psychological factors such as emotion, pessimism, optimism and over reaction. According to [2], people tend to spend more on Fridays hence the rise of stock prices on Fridays and less on Mondays hence less returns on Mondays. [29] Also argued most stock markets operate from Monday to Friday forcing most short sellers to close their speculative position on Fridays and reintroduce short positions on Monday causing stock price to rise on Friday and fall on Monday same is replicated on holiday effects. [30] gave a contrary finding by saying that seasonal anomalies are to the large extend influenced by financial trends as investors psychology is controlled by business cycle and their behaviour change is influenced by the market performance.

2.2.3 Information Asymmetry

The timing of giving out information concerning a particular stock matters to investors and speculators influences stock returns. It is believed that most Companies deliver bad news on Fridays and good news on Mondays hence the panic selling of stocks by investors on Friday, leading to high stock returns on Fridays compared to Mondays [2].

2.3 Research gap

The existing literature shows that the effects of seasonal stock market anomalies on stock markets across the world have generated varying results [5, 8]. The literature review has also revealed that most studies done have concentrated on developed economies hence the findings might be limited to such economies and not developing economies. Studies that have looked at seasonal market anomalies effects at Nairobi Security exchange have not explored all the extension of GARCH (1, 1) model such as EGARCH. Further. the studies done locally have not looked at the turn of the month effect and holiday effect using asymmetric EGARCH model hence this study sort to fill the gap and add knowledge on conditional variance modelling.

2.4 Operationalization of variables

TABLE 2. 1: Operationalization of variables

Category	Variable	Indicator	Measurement
Independent Variable	Day of the week Anomaly	% Increase or decrease	Average mean return of NSE 20 share Index for each day of the week compared to the rest of the days
Dependent Variable	Stock Market Return Volatility	% Increase or decrease	Closing price of the NSE 20 Share Index at time t (Pt) - Closing price of the NSE 20 Share Index at time t-1(P_{1-t}) / Closing price of the NSE 20 Share Index at time t-1(P_{1-t}) * 100 **$Rt = (Pt - P_{t-1}/P_{t-1}) *100$**

3 Research Methodology

The study adopted a descriptive research design to determine effects of seasonal market anomalies on stock market return and volatility among Companies listed at the NSE. [5] Expressed that descriptive research design is concerned essentially with tending to the specific attributes of a particular populace of subjects at either fixed point in time or at different occasions for similar purposes. It's optimal as it permits assortment of a lot of historical information from the NSE. The descriptive statistical analysis helped in understating the behaviour of each of the variables as it gave the mean, variance, maximum, minimum, skewness and kurtosis of the average mean return of each of the independent variable.

The population of interest for this study was the NSE 20 - Share Index from September 2000 to December 2019. NSE 20-Share Index is the average price-weighted index calculated as a mean of the top 20 best performing counters. The index is of interest as it's the major indices at the NSE hence most looked up to by investors.

Secondary data was gathered from the NSE database. We recorded the closing stock prices of the NSE 20- Share Index which is the average price weighted index calculated as a mean of the top 20 best performing counters. We looked at a total of 4824 daily observations minus weekends and public holidays, public holidays. All the data collected were first analysed in an excel spreadsheet, cleaned and uploaded to the Stata software version 12.0 to generate inferential statistics necessary for determining the relationship between the study variables.

The behaviour of the data was tested using descriptive statistics method. Exponential Generalized Auto-Regressive Conditional Heteroscedasticity Model (EGARCH) model was applied to capture the seasonality in returns.

Stock market return was computed as below:

$$Rt = (P_t - P_{t-1})/P_{t-1}) *100$$

Where Rt is the stock market return

Pt – Closing price of the NSE 20 Share Index at time t
Pt – Closing price of the NSE 20 Share Index at time t-1

The statistics included the summary of the observation which captured the mean, median, maximum value, minimum value, skewness and kurtosis for the returns of the entire period. Volatility model was developed to capture special features of the financial time series data such as, time varying volatility, volatility clustering, excess kurtosis, heavy tailed distribution and leverage effect (Eagle, 1982).

The EGARCH was used in the analysis. EGARCH (1, 1) was introduced by [18] to solve weakness of GARCH (1, 1) Model. He showed that EGARCH model give more accurate results compared to GARCH (1, 1) Model. [31] Noted that GARCH models had weaknesses which included lack of asymmetry in response to shocks since it gives the same weight to the negative and positive shocks and difficulty in measuring persistence in GARCH models. The GARCH model also has non-negativity restrictions on the parameters [6].

[18] Showed that EGARCH did not require condition of non- negativity constrains and that it allows for asymmetric effect between positive and negative assets returns. Therefore, EGARCH (1, 1) model was appropriate as it accounts for leverage effect; the fact that negative shocks lead to a higher rise in volatility than positive shocks of the same magnitude. This response normally shows the magnitude of response of the investors and speculators to market news.

The Mean and conditional variance of EGARCH(p, q) model is specified generally as;
Mean equation

$Rt = \mu + \varepsilon t$ (1)

Variance equation

$$\log(\sigma_t^2) = \alpha_0 + \sum_{i=1}^{p} \alpha_i \left|\frac{y_{t-i}}{\sigma_{t-i}}\right| + \gamma_i \left(\frac{y_{t-i}}{\sigma_{t-i}}\right) + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) \quad (2)$$

Where γ is the asymmetric response parameter that can take either a positive or negative sign depending on the effect of the future uncertainty, for a positive shock $\left(\frac{y_{t-1}}{\sigma_{t-1}}\right) > 0$, then E-GARCH (1, 1) becomes;

$$\log(\sigma_t^2) = \alpha_0 + (\alpha_1 + \gamma_1)\left(\frac{y_{t-1}}{\sigma_{t-1}}\right) + \beta_1 \log(\sigma_{t-1}^2) \quad (3)$$

For negative shocks, $\left(\frac{y_{t-i}}{\sigma_{t-i}}\right) < 0$ it implies that bad news would have higher impact on volatility and the E-GARCH (1, 1) becomes

$$\log(\sigma_t^2) = \alpha_0 + (\alpha_1 - \gamma_1)\left(\frac{y_{t-1}}{\sigma_{t-1}}\right) + \beta_1 \log(\sigma_{t-1}^2) \quad (4)$$

3.1 Model specification

We carried out diagnostic test on the data before fitting the model. The data was tested for normality using Shapiro-Wilk normality test, Arch Effect using Ljung Box test, stationarity test using Augmented Dickey - Fuller Test (ADF Test) and Serial Correlation using Breusch-Godfrey LM test for autocorrelation. The data was expected to pass this entire test before modelling. AIC and BIC criteria are commonly used to select suitable models. In this study, EGARCH (1, 1) model was selected to test the weekend effect, turn of the month effect and the holiday effect. The EGARCH Model has been found to be appropriate model for financial time serious data where the data is volatile in nature [32]. To analyse the weekend effect, turn of the month effect and holiday effect using EGARCH model, dummy variables was introduced into the model.

For this study the EGARCH (1, 1) model equation was as shown below.

$$\log(\sigma_t^2) = \omega + \alpha \left|\frac{\varepsilon_{t-1}}{\sigma_{t-i}}\right| + y\left(\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right) + \beta_1 \log(\sigma_{t-1}^2) \quad (5)$$

Where: $\log(\sigma_t^2)$ is the logarithm of the conditional variance;

ω, α, y &β are constant parameters to be estimated

α is the ARCH term that measures the magnitude of the shocks of the news about volatility

β is the GARCH term. It captures the persistence in the conditional variance

y Captures the asymmetries; if negative shocks are followed by higher volatility, then the estimate of y will be negative. $y > 0$, Indicates positive news while $y < 0$ indicates bad news.

3.2 Day of the Week Effect

$$\log(\sigma_t^2) = \omega + \alpha \left|\frac{\varepsilon_{t-1}}{\sigma_{t-i}}\right| + y\left(\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right) + \beta_1 \log(\sigma_{t-1}^2) + \delta 1D \quad (6)$$

For the day of the week effect equation (6) above was adopted. D is a dummy variable equal to j if is trading day and zero otherwise where (j=1,2,3,4&5), j=1 for Monday, 2 for Tuesday,3 for Wednesday,4 for Thursday and 5 for Friday.

3.3 Normality test

Financial time series data exhibit excess kurtosis and are skewed. Normality test checks whether the residuals are normally distributed where the hypotheses are;

H_0: $Returns\ are\ normally\ distributed$
H_1: $Returns\ are\ not\ normally\ distributed$

The univariate normality of variable is said to exist if kurtosis statistic falling between (-10.0, 10.0) and skewness statistic is within (-3.0, 3.0).
The Jarque Bera (JB) test for normality is commonly used and the test statistic for JB is;

$$JB = \left(\frac{S}{\sqrt{\frac{6}{T}}}\right)^2 + \left(\frac{K-3}{\sqrt{\frac{24}{T}}}\right)^2 \quad (7)$$

Where K is the sample kurtosis, S is the computed sample skewness while T is the total number of observations. Under the null hypothesis, the test statistic follows chi-square distribution with 2 degrees of freedom. The null hypothesis is rejected for the large values of JB.
In this research Shapiro Will test for normality was used in the analysis.

3.4 ARCH Effect Test

The Ljung Box test is a diagnostic tool used to test the ARCH effects. This test is used to find out whether the standardized residuals show ARCH behaviour. The test checks m autocorrelations of the residuals.

The Ljung Box test hypotheses are;
H_0: $No\ ARCH\ effects$
H_1: $Presence\ of\ ARCH\ effects$
The Ljung Box test statistic is defined as;

$$Q = n(n+2)\sum_{k=1}^{m}\frac{\hat{r}_k^2}{n-k} \quad (8)$$

Where $\hat{r}_k$ is the estimated autocorrelation of the series at lag k and m is the number of lags being tested. The null hypothesis of the Ljung Box test is rejected for greater values of chi-square distribution with h degrees of freedom at a level of significanceα. The degrees of freedom must account for the estimated model parameters so that $h = m - p - q$, where p and q indicate the number of parameters from the ARCH or GARCH model fit to the data.

3.5 Stationarity test

A stationarity time series is one whose properties such as mean and variance are all constant over time. Stationarity of the returns was done using Augmented Dickey Fuller test which assumes that the returns r_t is a random walk process with a drift such that $r_t = \emptyset_0 + \emptyset_1 r_{t-1} + \varepsilon_t$ where ε_t is a white noise process. The hypotheses are;

H_0: $\emptyset = 1$
H_1: $\emptyset < 1$

The ADF test statistic is given by;

$$ADF = \frac{\widehat{\emptyset}-1}{s.e(\emptyset)} \quad (9)$$

Where $\widehat{\emptyset} = \frac{\sum_{t=1}^{T} r_{t-1} r_t}{\sum_{t=1}^{T} r_{t-1}^2}$

For the ADF test, the null hypothesis is rejected for p-values less than the levels of significance α whereby the conclusion will be that the returns are stationary.

3.6 Auto-correlation Test

It is an assumption of regression analysis where the residuals would not correlate with anything else, including each other at different times [25]. Durbin's alternative test was used to detect the serial auto-correlation.

Null Hypothesis: There is no serial correlation
Alternative Hypothesis: There is serial correlation

Decision rule; at the point when the p-value is more than 0.05, we fail to reject the null hypothesis and conclude that there is no serial correlation on the residuals.

4 Results and Discussion

This section presents the study results and their findings. The findings realized are presented as guided by the study variables:

4.1 Descriptive Statistics

Table 4.1 give the mean, maximum, minimum, standard deviation, skewness and kurtosis for weekend effect for NSE 20 Share Index.

Table 4. 1: Descriptive Statistics of NSE 20 Share Index return of the Day of the Week Effect

Day of the week	Mean	Count	Max	Min	Std Deviation	Skewness	Kurtosis
	%		%	%	%	%	%
Monday	0.0001501	4822	9.01817	-3.141984	0.3664239	5.44536	123.4446
Tuesday	-0.003964	4817	5.55704	-8.242557	0.3908315	-1.279412	82.49833
Wednesday	0.0021481	4817	7.194616	-5.09933	0.3716803	0.9968548	67.22518
Thursday	-0.0011311	4824	4.757346	-4.416257	0.3474842	0.1059138	41.60104
Friday	0.0116865	4821	6.649682	-3.713791	0.3655151	2.185826	66.5378
All days	0.0089502	4824	0.0089502	-8.242557	0.8244827	0.6013403	15.62403

Table 4.1 summarised information on the NSE 20 Share Index daily return from 5 September 2000 to December 2019. There were 4824 daily observations for the day of the week effect. It was observed that the daily mean return for the NSE 20 share index for all days of the week was 0.0089502% with a standard deviation (volatility) of 0.8244827, skewness of 0.6013403 and kurtosis of 15.62403 thus rejecting normality of the data in the study period. The stock returns show excess kurtosis >3 indicating that they are leptokurtic.

Analysing the return for each day of the week, Friday recorded the highest mean return of 0.0116865% while Tuesday had the lowest mean return of -0.003964. The minimum index for Monday, Tuesday, Wednesday, Thursday and Friday was -3.141984%, -8.242557%, -5.09933%, -4.416257% and -3.713791 %. Tuesday had the lowest index among the minimum index in all the days of the week. The maximum index for Monday, Tuesday, Wednesday, Thursday and Friday was 9.01817%, 5.55704%, 7.194616%, 4.757346%, 4.757346% and 6.649682 %. Monday recorded the highest maximum index. All the days of the week recorded positively skewed results except for Tuesday which is negatively skewed, and excess kurtosis is observed in all the days of the week of the NSE 20 share index returns. The highest volatility (Standard deviation) of 0.3908315% is observed on Tuesday with Thursday recording the lowest volatility of 0.3474842%. This may temporarily show that the day of the week effect does not affect the stock market return volatility of the NSE 20 Share Index. This finding was inconsistent with [14].

4.2 Volatility clustering for the Day of the Week effect

Daily NSE 20 Share index from Sept 2000 to December 2019

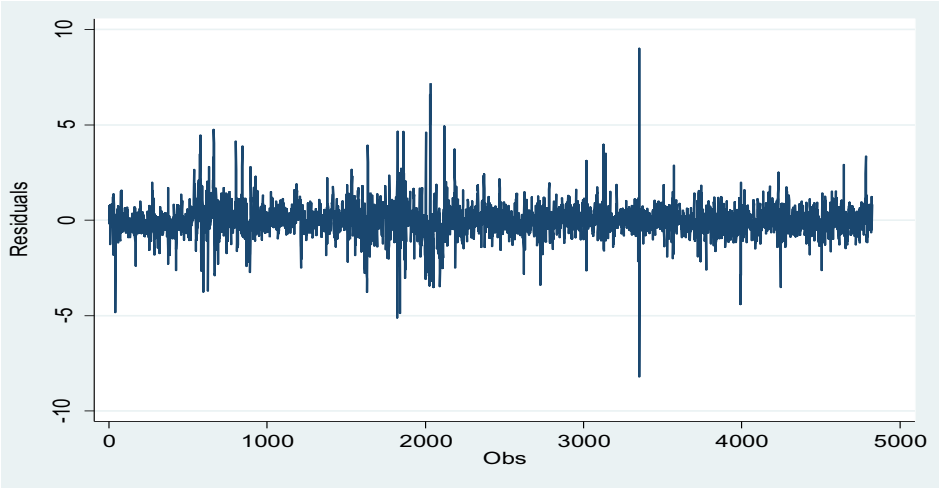

Figure 4. 1: Time Series plot for Day of the Week effect

From figure 4.1 of time series plot above, we observed volatility clustering of the daily stock returns. Periods of high volatility are followed by periods of high volatility and periods of low volatility are followed by periods of low volatility. A spike was witnessed between observation 1800 and again 3125. A return of up to Kshs.190 was witnessed in a day. The high volatility seen in the time series plot allows for the application of the GARCH family model. In this case, EGARCH is used as it appreciates the conditional variance variation and the asymmetric effect.

4.3 Ordinary Least Square (OLS) Regression analysis on Day of the Week Effect

Table 4. 2 : OLS Model results for Day of the Week effect

Number of Obs = 4824		F (4,4819) = 1.30			Prob > 0.2689
R-Squared = 0.0011		Adj R-Squared = 0.0002			Root MSE = 0.82143
Stock Returns	Coef.	Std.Err	T	P>/t/	95% Conf. Interval
D1	-0.0577044	0.03774	-1.53	0.126	-0.1316922 0.0162833
D2	-0.0789908	0.0373891	-2.11	0.035	-0.1522905 -0.0056911
D3	-0.045195	0.037408	-1.21	0.227	-0.1185318 0.0281417

D4	-0.0649199	0.3741175	-1.74	0.083	-0.1382752 0.0084354
Cons	0.0591952	0.0266087	2.22	0.026	0.00703 0.1113603

Null Hypothesis: Model Significant
Alternative Hypothesis: Model not significant

The p=0.2689 >0.05 hence we reject the null hypothesis and conclude that the model is not significant in explaining the weekend effect of the stock market return at the NSE.

Analysing the day the week effect OLS Model, table 4.2 showed Monday, Wednesday, Thursday are statistically insignificant, thus fails to confirm the Monday effect on the NSE 20 share index at the Nairobi Securities Exchange. Tuesday recorded the most negative but significant, confirming Tuesday effect. Friday showed a positive coefficient and significant confirming Friday effect of the NSE 20 share index stock returns at the NSE. This shows that investors at the Nairobi Securities Exchange can rely on market timing of the day of the week when trading on shares.

4.4 Testing for stationarity

The table below presents the findings on stationarity test conducted by the augmented dicker fuller test.

Table 4. 3: Augmented Dicker-Fuller test results – Daily returns (OLS)

	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-34.415	-3.430	-2.860	-2.570
MacKinnon approximate p-value Z(t) = 0.0000				

Null Hypothesis: Daily Stock Returns are not stationery
Alternative Hypothesis: Daily Stock returns are stationery

From the table 4.3, the p value of the Augmented Dickey – Fuller test is 0.000 < 0.05 we reject the null hypothesis and take alternative hypothesis and conclude that the returns are stationery hence desirable.

4.5 Testing for serial correlation

The conducted the autocorrelation test to test the existence of serial correlation as per the the table 4.4:

Table 4.4: Serial Correlation results- Day of the Week effect

Lags (p)	Chi2	Df	Prob > chi2
1	651.393	1	0.061

Breusch-Godfrey LM test for autocorrelation
Null Hypothesis: There is no serial correlation
Alternative Hypothesis: There is serial correlation

From table 4.4, the p-vales is 0.061 greater (>) than 0.05, we fail to reject the null hypothesis. Implying there is no serial correlation on the residuals. This is desirable.

4.6 Testing for Normality

The Shapiro Wilk Test for normality test was conducted as per table 4.5:

Table 4.5: Normality test on day of the week effect

Variable	Obs	w	V	z	Prob>z
R	4824	0.89327	280.109	14.769	0.2510

Null Hypothesis: Residuals are normally distributed
Null Hypothesis: Residuals are not normally distributed

From the model, p = 0.2510 which is greater than 0.05. We reject the null hypothesis and conclude that the residuals are not normally distributed. This is not desirable.

4.7 Testing for ARCH Effect

The LM test for autoregressive conditional heteroscedasticity (ARCH) was conducted on the day of the week effect as per table 4.6:

Table 4. 6: Arch Effect on Day of the Week effect

Lags (p)	Chi2	Df	Prob > chi2
1	1096.212	1	0.0000

Null Hypothesis: no ARCH effects
Alternative Hypothesis: ARCH (p) disturbance

The probability is 0.0000 less (<) than 0.05, the null hypothesis is rejected, and accept Alternative Hypothesis implying ARCH effect is present hence conditional variance is not constant. This is not desirable.

The results of the diagnostic test conducted on the OLS model to determine its reliability, fall short. The residuals are stationery although it has ARCH disturbance thus the need to use the EGARCH Model.

4.8 EGARCH on the Day of the Week Effect

The EGARCH model for the day of the week presented the results in table 4.7:

Table 4. 7: EGARCH for Day of the Week Effect

ARCH family regression Sample: 1 - 4824

Log likelihood = -5043.009					Prob > chi2 = 0.0003 Wald chi2(4) = 21.38	
	Day of the week	**Coefficients**	**Std Err**	**Z**	**p>/z/**	**(95% Conf.Interval)**
Mean Equation						
	Monday	-0.101287	0.0257173	-3.94	0.000	-0.1516919 -0.50882
	Tuesday	-0.0898868	0.0220958	-4.07	0.000	-0.1331937 -0.0465799
	Wednesday	-0.0622022	0.0240877	-2.58	0.010	-0.1094132 -0.0149912
	Thursday	-0.0576976	0.0241146	-2.39	0.017	-0.1049614 -0.0104339
	Cons.	0.0689459	0.0169215	4.07	0.000	0.0357804 0.102114
Variance Equation ω, α, y &β						
	ω (constant)	-0.0371593	0.0038750	-9.59	0.000	-0.0447556 -0.029563
	α	-0.0065516	0.007337	0.89	0.372	-0.00772886 0.0210265
	y	0.9188732	0.004901	184.14	0.000	0.9090927 0.9286537
	β	0.3857238	0.012569	30.69	0.000	0.361089 0.4103585

In the mean equation, Monday's recorded the lowest coefficient of -0.101287 which is statistically significant (0.000 <0.05), confirming the presence of Monday Effect. Friday has the highest coefficient of 0.0689459 which is also statistically significant (0.000< 0.05). This implies that day of the week effect influences the stock returns with Mondays recording lowest returns and Fridays record highest returns. This finding is consistent with previous studies at the Nairobi Securities Exchange [32] and other global studies [12].

The conditional variance equation, the Arch (α) is not significant while the Garch (β) is significant meaning previous days volatility can influence the volatility of today's stock return .The leverage effect (y) is positive with significant p-value confirming positive shocks (good news).Thus no leverage effect. The positive asymmetric term implies that positive shocks have greater impact on volatility than negative shocks of the same magnitude.

4.9 Post diagnostic tests on the EGARCH Model

The finding on the serial correlation of post diagnostic test on day of the week effect is presented in table 4.8:

TABLE 4. 8 : Serial correlation of post diagnostic test on Day of the Week Effect

						-1 0 1
LAG	AC	PAC	Q	Prob>Q	AC	[Partial Autocor]
1	0.3669	0.367	1.6498	0.2893	1	1
2	-0.2433	-0.1255	1.9356	0.5402	1	1
3	-0.1193	-0.0057	2.1004	0.6476	1	1
4	-0.0327	-0.0406	2.1011	0.6306	1	1
5	-0.0055	-0.009	4.0101	0.746	1	1
6	-0.0152	-0.0115	4.1011	0.6633	1	1
7	-0.0181	-0.0052	5.1012	0.7104	1	1
8	-0.008	-0.0069	5.1013	0.7981	1	1
9	-0.0216	-0.0326	6.1015	0.7724	1	1
10	-0.0188	-0.0038	6.1017	0.7993	1	1
11	-0.0288	-0.0132	7.1021	0.847	1	1
12	-0.0188	-0.0021	7.1022	0.8683	1	1
13	-0.0285	*0.0181	8.1026	0.8852	1	1
14	-0.0341	0.0193	8.1032	0.8693	1	1
15	-0.0246	-0.0026	8.1035	0.9076	1	1

Null Hypothesis: There is no serial correlation in the residual
Alt Hypothesis: There is a serial correlation

From the table above, the p-values are all greater than 0.05 we fail to reject the null hypothesis and conclude that there is no serial correlation hence we conclude that the model is a good fit. The Q-statistics values are greater than 0.05 indicating absence of the ARCH effect.

5 Conclusion and Recommendations

This section presents the summary conclusions of the study, recommendations and areas for further research:

5.1 Conclusion

The descriptive statistics results did not show the Day of the week effect at the NSE although the turn of the month effect and the holiday effect was confirmed to exist at the NSE. The EGARCH estimations mean equation shows that Friday exhibited the highest significant returns with Monday having the lowest significant returns hence confirming the presence of day the week effect at the NSE. The positive asymmetric on the Day of week effect shows a decrease in the volatility of the returns at the NSE.

Positive leverage effect is associated with good news/positive information and volatility tend to below as risk averse investors tend to which is normally associated with high volatility. The results show presence of day of the week anomaly of NSE 20 Share Index implying that the NSE is not efficient; this contradicts the efficient market hypothesis theory which states that stock markets are efficient. The difference in the mean return of the days of the week also shows that the return is random and not static confirming the random walk theory. The findings confirm the prospect theory through the movement of stock at times. The findings on the day of the week anomalies imply that investors can make predictions by relying on market timings as the inefficiency in the market open the possibility of formulating profitable trading rules of earning abnormal returns when investing on the NSE 20 share index at the Nairobi Securities Exchange.

5.2 Recommendations

The study finds the presence of day of the week anomaly at the NSE which means the NSE is not efficient. The Capital Market Authority of Kenya which is the umbrella body tasked with mandate of ensuring the creation of regulation in the capital market where securities can be issued, treated in an orderly, fair, and efficient manner; should look for appropriate measures, strategies, regulations and policies to ensure an appropriate system is implemented and information availed at all-time to all market participants to ensure fair and efficient market.
The study also recommends the stock market investors/participants to first examine the market to observe the trend to help them develop a portfolio that will aid them in ensuring they maximize returns at all time. This is because there are other forces that influence the market returns like the symmetric risks and volatility of the stock returns.

5.3 Areas for further studies

The study used EGARCH (1, 1) model in the analysis, the model does not take into consideration auxiliary movements in its present structure. Extending the model to accommodate potential movements would presumably improve the results as well as the forecasting accuracy. Further studies may be carried out for other extensions to the GARCH model like T-GARCH, M-GARCH P-GARCH and I-GARCH and compare the results. This study focused on NSE 20 share Index, a similar study can be carried out on NSE All Share Index and other market segments.
Although Nairobi Securities exchange is the leading market in East African, market indices from other East Africa Counties like Uganda, Tanzania, Burundi and Rwanda can be considered in future and this study replicated for comparison. A wider scope can also be taken into consideration.

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