The Day of the Week effect on stock market returns and volatility: Evidence from Nigeria and South Africa.

Ndako, Umar Bida

Department of Economics Bayero University Kano P.M.B.3011 Kano, Nigeria

5 July 2013

The Day of the Week effect on stock market returns and volatility: Evidence from Nigeria and South Africa.

BY

UMAR BIDA NDAKO
Department of Economics
Bayero University Kano
P.M.B.3011 Kano, Nigeria
Email: umarbida@yahoo.co.uk

Abstract:
This paper examines the day of the week effect for the Nigerian and South African equity markets over pre-liberalisation and post-liberalisation periods. The paper uses Exponential Generalized Autoregressive Conditional Hetroskedasticity (EGARCH) model to estimate the day of the week effect both in the mean and variance equations. The post-liberalisation period for the Nigerian equity market exhibits day of the week effect on Fridays only in the mean equation. While in the variance equation, there is evidence of day of the week effect on Tuesdays and Thursdays respectively. In South Africa, there is significant evidence of the day of the week effect on Mondays and Fridays during the pre-liberalization period. During the post-liberalisation period, there is evidence of day of the week effect on Thursdays in the mean equation and Fridays only in the variance equation.

JEL Classification: C22, G10, G12
Keywords: day of the week effect; volatility; E-GARCH model

1 Introduction

The issue of the day of the week or anomalies in stock returns, foreign exchange and T-bill markets are well documented and widely examined in the literature of financial markets. As observed by Basher and Sadorsky (2006) examining day of the week effect is very crucial to investors because it provides the necessary information to investors to adjust their portfolio based on the abnormality of the calendar effect. For example, investors could buy stocks with days of abnormal returns and sells stocks with days of abnormally high returns. Earlier works in this area include Cross (1973), French (1980), Gibbons and Hess (1981), Keim and Stambaugh (1984) and Aggarwal and Rivoli (1989). However, all of the above works focus only on the mean equations of the stock market returns and use Ordinary Least Squares (OLS) estimation method to regress returns on five daily dummy variables.

Recent empirical studies are now considering not only the mean returns but also the variance equations. This can be found in the studies by Hsieh (1988), Berument and Kiymaz (2001), Kiymaz and Berument (2003) and Yalcin and Yucel (2006). Considering day of the week in the variance equation also has the support of Engle (1993) as he points out that those risk-averse investors would reduce their investment on those assets which are likely to increase in volatility. Therefore, consideration of both returns and volatility are critical to investors. Kiyamaz and Berument (2003) clearly show that investors are not only interested about a day returns but also about the corresponding volatility of the day and having such knowledge allow investors to adjust their portfolios by taking into account day of the week variation in volatility.

Many studies on the day of the week both on developed and other emerging markets have used GARCH (1, 1) model to examine the effect on the day of the week. This study, however, uses the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. The main essence of using the EGARCH model is to capture the possible asymmetric effect which is not possible with GARCH (1, 1) models. It shows the leverage effect, that is the reaction of the investors to the news in the markets. When volatility rises it means investors are responding to bad news and when it falls it means they are responding to good news. Also with the EGARCH model, we do not require the assumption of non-negativity restriction, which ensures that all coefficients are positive under GARCH (1, 1) model.

Although there are several works on Sub-Saharan Africa countries on day of the week effect, there has not been much effort in examining the asymmetric effect of the data. This study attempts to fill this gap by examining day of the week effect for Nigerian and South African equity markets using the EGARCH model. The study follows Kiyamaz and Berument (2003) by considering day of the week in both returns and variance specification. Whilst Kiyamaz and Berument (2003) use GARCH (1, 1) model, this study uses EGARCH model.

The motivation for this work is based on the fact that both Nigeria and South Africa liberalise their financial markets in 1995 and as expected, it has provided opportunities for foreign investors to actively participate in these markets which in turn increases the level of liquidity, saving and growth of these economies. However, experience has shown particularly from the South East Asia that these huge potentials are often characterised by a high level of uncertainty or volatility as explained by Singh (1997), Stiglitz (2000), Allen and Gale (2000). This partly explains why we estimate the day of the week effect both in the mean and in variance equations. Evidence from figure 1 below indicates the daily stock returns for Nigeria and South Africa respectively. Both returns clearly exhibit volatility clustering, which is high period is followed by low period volatility. It evolves over time in a continuous manner and it is asymmetric, responding to increasing and decreasing in prices.

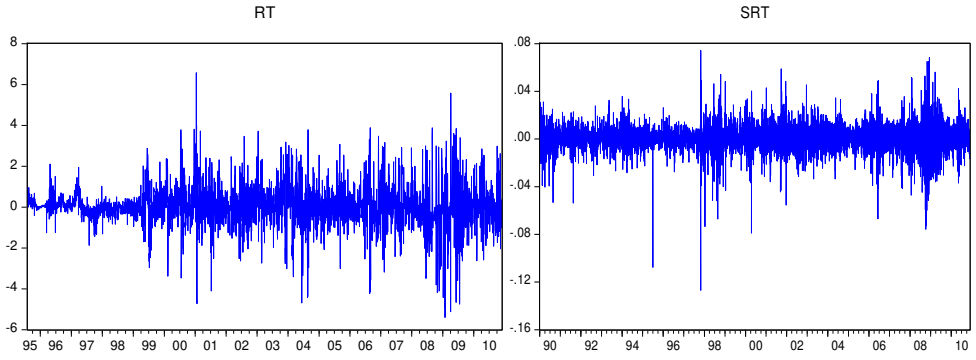
The objective of this study is therefore to examine the day of the week effect both in the mean and variance equations for Nigerian and South African equity markets respectively. The choice of Nigeria and South Africa for this study is due to their important economic role in sub-Saharan Africa; they are the two biggest economies in Sub-Saharan Africa. The two economies also have rich experiences in economic and financial sector reforms over the past two decades. The study covers two periods: the pre-liberalisation and post-liberalisation periods except for the Nigerian daily returns, which cover only the post - liberalisation period due to lack of data for the pre-liberalisation period. The pre-liberalisation period is simply the period before the domestic markets open up to foreign investors while post-liberalisation is after the markets have become internationalised.

The main finding from the study is that for the Nigerian equity market, there is evidence of day of the week effect on Fridays only in the mean equation. While in the variance equation, there is evidence of day of the week effect only on Tuesdays and Thursdays respectively. In South Africa, there is significant evidence of the day of the week on Mondays and Fridays during the pre-liberalisation period. During the post-liberalization period, there is evidence of day of the week effect on Thursdays in the mean equation and Fridays only in the variance equation.

Following this introduction, Section two comprises a brief review of the Nigerian and South Africa capital market development. Section three is the literature review and section four consists of data source and model specification. Section five gives the analysis of the empirical results and section six concludes the paper.

Figure 1: Stock daily returns for Nigeria and South Africa

Stock daily returns for Nigeria Stock daily returns for South Africa



2. Brief review of Nigerian and South African Equity market development

The Nigerian Stock Exchange (NSE) is relatively young when compared with establishment of Nigerian commercial banks. It started operations in mid-1961 with eight stocks and equities; there were also about seven UK firms quoted on NSE which had, at the same time, dual quotations on the London Stock Exchange. At the commencement of operations, the NSE started with 0.3 million shares worth N1.5 m in 334 deals and the value continued to grow steadily to N16.6m in 634 deals by 1970 (CBN 2004).

Since the 1960s up to the late 1980s, trading at the NSE was dominated by government securities and this was partly explained by the implementation of the Nigerian Enterprises Promotion Decree of 1972 and 1977 which allowed a high level of public participation in the capital market. Also prior to the deregulation of the Nigerian capital market in 1995, the pricing of new issues was controlled by the SEC as against firms' preferences for a market determined pricing system (CBN 2004).

In 1995 the Federal Government liberalised the capital market with the abrogation of Laws that prevent foreign investors from participating in the domestic capital market. This includes: The Foreign Exchange (Monitoring and Miscellaneous Provision Decree No: 17, 1995; Nigerian Investment Promotion Commission Decree No: 16, 1995; Companies and Allied Matters Decree of 1990 and Securities and Investment Act (ISA) 45 of 1999[1].These legislations have accorded Nigerians and foreign investors the same right, privileges and opportunities for investment in securities in the Nigerian capital markets. Other key measures include: The Central Security Clearing System (CSCS) which commenced operations in April 1997. It is a central depository for all the share certificates of quoted securities including new issues. The coming of the CSCS has made the trading on the NSE to be carried out on an Automated Trading System (ATS), which enable a market order to be carried out in transaction days T+3 days (NSE 2009). Also in July 2002, the stock exchange introduced the e-business platform, which makes it possible for investors in the Exchange Market to access their CSCS database from the Exchange Website for the purpose of monitoring movement in their stock accounts[2].

In 2007, the SEC approved the establishment of the Investors Protection Fund (IPF) with the objective of compensating investors who suffer losses as a result of insolvency, bankruptcy or negligence on the part of a dealing member firm of a securities exchange. Also in 2007, to further deepen the market, the NSE launched new products, including mortgage-backed securities, asset-backed securities, derivatives and exchange- traded funds.

In 2008, the NSE crashed and suffered the heaviest loss in its history; although the global financial crisis partly contributed to this, the main source of the crisis could be traced to insider abuse, share manipulation, margin loan scandals and other negative activities perpetuated by operators of the market. The stock market had less than N1trillion market capitalisation in 1999 but this jumped to N15.3 trillion in the first quarter of 2008, however, this amount plummeted to N7.53 trillion in the first week of November 2008 (NSE 2009).

The Johannesburg Stock Exchange (JSE) is the oldest in Sub-Saharan Africa established in 1887. The JSE is now the most developed stock market in the Africa. It has undergone for the past two decades a series of reforms particularly since the introduction of the constitutional democracy and the end of apartheid in 1994. This has helped to increase its performance and competitiveness at the global stage. World Bank (2007) indicates that the Johannesburg Stock Market is ranked the fourth largest among the emerging markets. The IMF (2008) also confirms that South Africa's financial system is the most robust in terms of financial infrastructure and prudent macroeconomic management. In May 2002, JSE replaced its trading system with the securities trading system of the London Stock Exchange. This further helps in increasing the level of confidence of the investors in the JSE. It also helps in reducing the thinness level of the trading and improving the level of market liquidity. In 2004, the JSE established the Alternative Exchange (ALTx) which is a platform that

[1] The Decree No: 16 and 17 replaced the abrogated Nigerian Enterprises Promotion Decree of 1989 and Exchange Control Act of 1962 respectively. However, the Investment and Securities Act (ISA) 2007 repealed the ISA 45 of 1999 and subsequently those earlier decrees.

[2] This paper is an abridged version of a section of the empirical chapter of my PhD thesis at University of Leicester.

promotes small and medium-sized companies from all sectors of the economy especially those that have the potential to grow are encouraged to get enlisted. Currency derivatives were also launched in 2007 by the JSE and these provide opportunities for investors to hedge against major currency fluctuations. (Ndako, 2010)

3 Literature Review

Many empirical works on the day of the week effect in stock returns have been conducted both in developed and emerging markets. Earlier studies include Osborne (1962), Fama (1965), Cross (1973), and French (1980). Others include Gibbons and Hess (1981), Keim and Stambaugh (1984), Jukuns (1986), and Lakonishen and Smidt (1988). All these studies arrived at different conclusions on the effect on the day of the week.

Athanassakos and Robinson (1994) and Dubois and Louvet (1996) both examine day of the week effect for both developed and emerging markets in their studies. They obtain negative Monday stock returns for the United States, European and Hong-Kong markets and negative Tuesday stock returns for Australia, Japan and South Korea respectively. Meanwhile, earlier studies by Kato (1990) also obtained low Tuesday and high Wednesday for Japan. Studies by Poshakwale and Murinde (2001) establish a significant negative day of the week on Monday and positive on Friday for Hungary and Poland stock markets. Brooks and Persand (2001) evaluate the evidence of the day of the week for five Southeast Asia: Malaysia, South Korea, The Philippines, Taiwan and Thailand. They find a significant day of the week effect in three of the five stock markets studied. However, they further conclude that market risk alone may be insufficient in capturing the calendar anomalies. Hui (2005) using non-parametric test, examines day of the week effect for four Asian Pacific markets and two developed markets. He establishes that Hong-Kong, Taiwan and Singapore show higher average returns on Fridays and lower average returns on Mondays but the United States, Japan and South Korea show a mixed pattern. In the overall, it is only Singapore that shows a significant day of the week effect. In their studies of Chinese stock markets, Cai et al. (2006) establish the presence of the day of the week effect with negative returns on Mondays and Tuesdays after controlling for the effect of spill over and autocorrelation.

Recent empirical studies also consider day of the week effect on volatility. Berument and Kiyamaz (2001) in addition to stock returns also consider day of the week effect on volatility. They examine the S&P 500 stock index for the period 1973-1997 and find a significant day of the week effect both in returns and volatility equations. They establish a significant highest and lowest day of the week effect on Wednesday and Monday for returns equations, and highest and lowest volatility on Friday and Wednesday respectively. Kiyamaz and Berument (2003) also find a significant day of the week both in returns and volatility equations using daily stock indexes for Canada, Germany, Japan, United Kingdom, and the United States. They find highest volatility on Mondays for Germany and Japan, Fridays for Canada and United States and Thursdays for the United Kingdom.

Basher and Sadorsky (2006) using both unconditional and conditional risk analysis, examine day of the week effect for 21 emerging markets. They find no significant day of the week effect for the majority of emerging markets studied except the Philippines, Pakistan and Taiwan, which exhibit day of the week after adjusting for market risk.

Charles (2010) examines the asymmetric effect on the day of the week effect for five major international stock markets: France, Germany, United States, United Kingdom and Japan. Using daily stock returns, he establishes that it is possible that day of the week may create asymmetry in the series but there is not sufficient evidence that it influences the seasonal effects. Hogholn and Knif (2010) use different levels of portfolio aggregation examine

whether it is possible to examine the aggregation level effect of those factors driving the day of the effect. They conclude that the days of the week structure are more pronounced in the conditional volatility in the mean returns.
Some of the studies in Africa include Aly et al. (2004), Agathee (2008), Chukwogur (2008) and Tachiwon (2010). Aly et al. (2004) examine day of the week effect using daily stock returns for Egypt. On the average, the study indicates a positive and significant Mondays' returns but there is no indication of the day of the week. Tachiwon (2010) give an analysis of day of the week effect of the West African regional stock market for the period 1998-2007. He observes lowest returns on Tuesdays and Wednesdays and highest returns on Fridays.

4 Econometric methodology

In this study, we use the exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model of Nelson (1991). He has shown that the EGARCH model performs better than the GARCH (1, 1) model. This is because EGARCH model does not require the condition of non negativity. That is it does not require a situation that ensure coefficients to be positive. The EGARCH model also allows us to capture the asymmetric characteristics of data. This is against the GARCH (1, 1) model which is based on symmetric assumption. Therefore, EGARCH model provides the opportunity for the leverage effect, which usually indicates the level of response of the investors to market news. Volatility tends to rise in response to bad news (i.e. lower unexpected stock returns) and fall in response to good news (i.e. higher unexpected stock returns). This idea is motivated by the earlier empirical work of Black (1976), Christie (1982) and French, Schwert, and Stambaugh (1987). Therefore, good news and bad news have different predictability for future volatility as against other GARCH models which show symmetric effects. This paper employs the EGARCH model and it is specified under two equations: the mean and conditional variance equations.

Mean equation

This is specified as follows:

$$Yt = \mu + \varepsilon_t \tag{1}$$

Variance equation

$$\log(\sigma^2) = \omega + \beta.\log({\sigma^2}_{t-1}) + \gamma \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}}} \alpha \left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}}} - \sqrt{\frac{2}{\pi}} \right] \tag{2}$$

Where ω, β, γ and α are constant parameters to be estimated. Conditional variance $\log(\sigma^2)$ indicates that even if the parameters are quite negative, $\log(\sigma^2)$ will still be positive. α Is the ARCH term that measures the magnitude of the shock of the news about the volatility. β on the other hand is the GARCH term and it captures the persistence in the conditional variance. A large positive β indicates that it will take a long time for the persistence to die out following a shock the stock markets. The γ measures the leverage effect; the idea γ is expected to be negative showing that the bad news has a bigger impact on volatility than the good news of the same magnitude. If $\gamma = 0$ indicates symmetric $\gamma > 0$ indicates positive news and if $\gamma < 0$ this indicates bad news. The news impact curve (NIC) relates ε_{t-1} to σ^2 in such a way that past stock returns are related to current volatility. This study therefore Follows Engle and Ng (1993) to plot the news impact curves from the EGARCH model. The curve enables us to measure the relationship between the news and future volatility. The values of the residuals usually increase exponentially in two directions of either positive or

negative parameters. If the parameter is positive, it is an indication of good news arrival in the market and as expected investors will react more to positive news than negative news. However, if the parameter is more negative, that means bad news arrival to the market and investors will react accordingly.

$$ht = A\exp\left[\frac{(\gamma+\alpha)}{\sigma}\varepsilon t-1\right] \text{ for } \varepsilon t-1>0$$
$$ht = A\exp\left[\frac{(\gamma-\alpha)}{\sigma}\varepsilon t-1\right] \text{ for } \varepsilon t-1<0 \quad (3)$$

Where $A \equiv \sigma^{2\beta}\exp\left[w-\alpha\sqrt{2/\pi}\right]$, σ is the standard deviation and w is the constant term, β is the parameter of the log ($(ht-1)$ term, while α is the parameter for the $|\varepsilon t-1|/\sqrt{ht-1}$ term and γ is the parameter for the $\varepsilon t-1/\sqrt{ht-1}$ term in the EGARCH log-variance equation

The model is specified in two ways: first is the specification of the mean returns only and the second specification comprises both days of the week effect in return and volatility equations.

$$Rt = \alpha o + \alpha_M M_t + \alpha_T T_t + \alpha_{TH} TH_t + \alpha_F F_t + \sum_{I=1}^{n}\alpha_i R_{t-i} + \varepsilon_t$$
$$\log(\sigma^2) = \omega + \beta.\log(\sigma^2{}_{t-1}) + \gamma\frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}}}\alpha\left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}}}-\sqrt{\frac{2}{\pi}}\right] \quad (4)$$

$$Rt = \alpha o + \alpha_M M_t + \alpha_T T_t + \alpha_{TH} TH_t + \alpha_F F_t + \sum_{I=1}^{n}\alpha_i R_{t-i} + \varepsilon_t$$
$$Log(\sigma^2) = V_C + V_M M_t + V_T T_t + V_{TH} TH_t + V_F F_t + \log(\sigma^2) = \omega + \beta.\log(\sigma^2{}_{t-1}) +$$
$$\gamma\frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}}}\alpha\left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}}}-\sqrt{\frac{2}{\pi}}\right] \quad (5)$$

Where Rt is the return and M, T, TH and F are the dummy variables for Mondays, Tuesdays, Thursdays and Fridays at time t respectively. The small n is the lag order which is included to eliminate the possible autocorrelation in the series. Each day takes the value of 1 and 0 otherwise and Wednesday's dummy is excluded in order avoid the dummy variable trap.

4.1 Data and official Dates for Stock Market Liberalization

This paper uses daily stock price indexes of the Nigeria Stock Exchange (NSE) and Johannesburg Stock Exchange (JSE). The Nigerian daily data are obtained from Data stream International (NSE all shares index, S&P/IFCG index). The daily data for South Africa are obtained from the JSE and Data stream International (JSE/Actuaries and FTSE/JSE). The returns are obtained from the log difference change in the price index

$Rt = \log Pt - \log Pt - 1$

The total sample of the Nigerian daily return series covers August 1st, 1995 to November 30th, 2010 [4001 observations] For South African daily return series, it covers the period January 1st 1990- November 30th, 2010, [5456 observations]

Table 1
The official liberalization dates for the two countries are summarised in the table below:

Country	Bekaert-et al (2003)	Fuchs-Schundeln and Funke (2003)	Bekaert et al (2005)
Nigeria	08/1995	**08/1995**	1995
South Africa	1996	**03/1995**	1996

5. Empirical Results

The empirical results are presented in three stages: the first stage is the presentation of summary statistics; the second stage is the day of the week effect. The third stage is the presentation of the news impact curves.

Table 2
Summary Statistics for Stock Returns in Nigeria and South Africa –Daily data

Nigeria	Full-sample (Aug 95- Nov 2010)	Pre-liberalisation	Post-liberalisation (Aug 95 – Nov 2010
Mean	0.0551	-	0.0551
S.D	0.0164	-	0.0164
Skewness	-0.0870	-	-0.0870
Kurtosis	6.8613	-	6.8613
J. Bera	2490.0***	-	2490.0***
Observation	4001	-	4001
South Africa	Full-sample (Jan 90- Nov 2010)	Pre- liberalisation (Jan 90 – Feb 95)	Post-liberalisation (Mar 95 – Nov 2010
Mean	0.0004	0.00041	0.0296
S.D	0.0121	0.0093	0.9996
Skewness	-0.6064	-0.4015	-0.8158
Kurtosis	10.625	5.984	12.207
J. Bera	13647***	535.87***	14964***
Observation	5456	1346	4110

Note: *** 1% level of significance

Table 2 gives the summary statistics for Nigerian and South African daily data. The results essentially cover for two periods: pre-liberalisation and post-liberalisation periods respectively. Meanwhile the Nigerian daily return series covers only the post-liberalisation period as there is no available data for the pre-liberalisation period.
For Nigeria, the daily mean return is positive with an average return of 5.5% for the post liberalisation period. It indicates a negative skewness and a kurtosis that is above 3. It also fails the Jarque-Bera normal distribution hypothesis at the 1% level of significance.

For South Africa, the daily mean returns are greater than zero for all the three sample periods with the daily average return of 0.04%, 0.04% and 2.96 % for the full sample, pre-liberalisation and post liberalisation periods respectively. Volatility measured by standard deviation indicates a high level of volatility in the post liberalisation period than in the pre -

liberalisation period. The results also show a negative skewness and a kurtosis that is quite above 3 for all the three samples, clearly indicating a leptokurtic distribution. Jarque Bera also rejects the null hypothesis of a normal distribution.

Table (3) presents the Nigerian post-liberalisation period. Estimates from the mean equation shows that the returns for the other days of the week are not significantly different from Wednesday. This means there is no day of the week effect in return equation. The highest return is recorded on Fridays with 1.2% and this is followed by Thursdays and Tuesdays with 1% and 0.6% respectively. However, evidence from the estimates of both returns and variance equations show that in the mean equation, there is a significant day of the week effect on Fridays, which is statistically significant at the 5% level. From the conditional variance equation, it can be observed that the volatility of Tuesdays and Thursdays is different from Wednesdays and statistically significant at 5% and 10 % level respectively. Fridays' volatility is lower than Wednesdays' and the high volatility in the week is recorded on Tuesdays. Therefore, for the Nigerian post-liberalisation period, there is Friday effect in the mean equation and both Tuesday and Thursday effects in the variance equation. The diagnostic tests indicate absence of autocorrelation and no ARCH effect at lag (12) from the data estimation

Tables (4) and (5) present the estimates of the day of the week effect for pre- and post-liberalisation periods in South Africa. The results are presented in return and also both in return and in volatility equations. In the pre-liberalisation period, the returns are not significantly different from Wednesdays except for Mondays which is different from Wednesdays at 5% level of significance. This suggests that the returns for Wednesdays are higher than Mondays. Thursdays produce the highest returns during this period while the lowest returns are recorded on Mondays.

In the return and volatility equations, the results of the returns do not significantly change. Mondays' returns are still the only returns that are significantly different from Wednesdays at 5% level of significance with the highest returns still on Thursdays but lowest on Fridays. For the return and conditional variance equation, the estimated coefficients indicate evidence of the day of the week effects on Mondays and Thursdays at 5% and 10 % level of significant respectively. For the conditional variance, the evidence shows that the volatility of Fridays is significantly different from the Wednesdays' volatility. The highest volatility occurs on Fridays while the lowest occurs on Mondays indicating that Wednesdays' volatility is higher than Fridays. Therefore, for South Africa, there is a Monday and Thursday effect in the mean equation only for the pre and post-liberalisation periods. There is a Friday effect on the estimates of the variance equation.

The diagnostics statistics of both Ljung-Box Q-statistics at levels and at squares indicate no serial correlation at lag 12 respectively. The ARCH-LM test also indicates no ARCH effect.

In the post-liberalisation period, there is no day of the week effect. All the days' returns are not significantly different from Wednesdays with the highest returns in the week being Thursdays followed by Mondays, and the lowest returns in the week being Tuesdays. The conditional variance equation indicates that the variances for the day of the week are not significantly different from Wednesdays for South Africa. Mondays have lower volatility than Wednesdays while higher volatility of the week is observed on Fridays. The autocorrelation tests show absence of autocorrelation at lag 12 and no ARCH effect in the data.

Table3 Day of the week effect (post-liberalization period) for Nigeria

Estimates of return equation	*Estimates of return and volatility equations*
Constant 0.04003	Constant 0.0247
(3.359)	(1.307)
Monday- 0.0190	Monday -0.0318
(-1.537)	(-1.638)
Tuesday -0.0059	Tuesday 0.0131
(0.504)	(0.728)
Thursday 0.0100	Thursday 0.0263
(0.776)	(1.511)
Friday 0.0127	Friday 0.0583***
(0.899)	(4.126)
Rt(-1) 0.3463***	Rt(-1) 0.3545***
(21.07)	(22.41)
Rt(-1) 0.1334***	Rt(-2) 0.1124***
(7.829)	(7.111)
Volatility	*Volatility*
ω -0.2486	ω -0.3072***
(-15.36)***	(-5.626)
α 0.3245	α 0.3646***
(15.00)***	(24.95)
γ 0.0392	γ 0.0283***
(2.917)***	(2.902)
β 0.9872	β 0.9681***
(325.92)***	(347.23)
Diagnostic test	Monday - 0.0704
Ljung Box (12) Q stat. - levels	(-0.961)
8.013 (0.476)	Tuesday 0.2403***
Ljung Box (12) Q stat.-squares	(2.804)
4.938 (0.895)	Thursday- 0.1656*
ARCH LM Test	(-1.822)
0.2567	Friday 0.0475
	(0.642)
	Diagnostic test
	Ljung Box (12) Q stat.- levels
	8.057 (0.153)
	Ljung Box (12) Q stat.-squares
	11.546 (0.317)
	ARCH LM Test
	0.3535

Z-statistics and probabilities are in parentheses for the return and volatility estimation and diagnostics tests respectively. (***) (**) (*) indicate the statistical level of significance at 1%, 5% and 10% respectively. Rt (-1) and Rt (-2) indicate autocorrelation lags.

Table4 Day of the week effect (pre-liberalization period) for South Africa

Estimates of return equation	*Estimates of return and volatility equations*
Constant 0.0008**	Constant 0.00099**
(2.1715)	(2.1699)
Monday -0.0251**	Monday -0.00014**
(2.134)	(-2.079)
Tuesday -0.0008	Tuesday -0.00086
(1.574)	(-1.359)
Thursday 0.0001	Thursday 0.00009
(0.212)	(-0.147)
Friday -0.00083	Friday -0.00091
(-1.5024)	(-1.476)
Rt(-1) 0.1648	Rt(-1) 0.1767
(-6.687)***	(7.2705)***
	Volatility
Volatility	ω -0.0742
ω -0.7326	(-0.446)
(-38.35)***	α 0.2820***
α 0.2532	(3.436)
(6.775)***	γ 0.0028
γ -0.0497	(0.0216)
(-2.334)**	β 0.09849
β 0.9446	(124.18)***
(262.57)***	Monday 0.2395
	(1.1634)
Diagnostic test	Tuesday -0.3776
Ljung Box (12) Q stat.- levels	(-1.544)
13.698 (0.320)	Thursday -0.0222
Ljung Box (12) Q stat.-squares	(-0.0904)
9.924 (0.678)	Friday 0.5565
ARCH LM Test	(2.644)**
0.8066	*Diagnostic test*
	Ljung Box (12) Q stat.- levels
	9.0930 (0.695)
	Ljung Box (12) Q stat.-squares
	14.284 (0.283)
	ARCH LM Test
	0.8251

Z-statistics and probabilities are in parentheses for the return and volatility estimation and diagnostics tests respectively. (***) (**) (*) indicate the statistical level of significance at 1%, 5% and 10% respectively. Rt (-1) indicates autocorrelation lags.

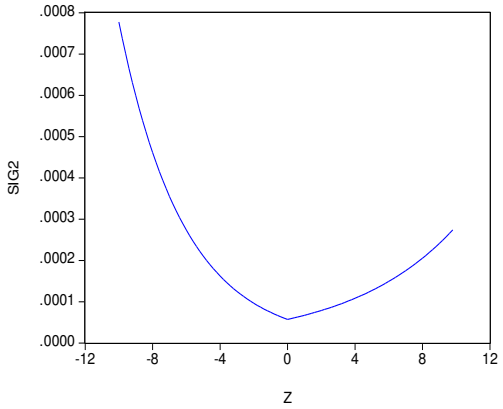
Table5 Day of the week effect (post-liberalization period) for South Africa

Estimates of return equation	*Estimates of return and volatility equations*
Constant 0.0003	Constant 0.00059*
(1.120)	(1.802)
Monday 0.0012**	Monday 0.0007
(2.804)	(1.465)
Tuesday -0.0013	Tuesday -0.00045
(0.018)	(-1.049)
Thursday 0.0007	Thursday 0.0008*
(1.638)	(1.769)
Friday -0.00005	Friday -0.00052
(-0.135)	(-0.006)
Rt(-1) 0.0816***	Rt(-1) 0.0908***
(5.202)	(5.368)
Volatility	*Volatility*
ω -0.3015***	ω -0.5927***
(-7.785)	(-8.695)
α 0.1608***	α 0.1865***
(10.62)	(19.20)
γ -0.0571***	γ -0.0971***
(-5.941)	(-16.15)
β 0.9802***	β 0.9600***
(266.2)	(271.36)
Diagnostic test	Monday -0.0689
Ljung Box (12) Q stat. - levels	(-1.053)
8.554 (0.575)	Tuesday -0.0237
Ljung Box (12) Q stat. -squares	(-2.606)
1.317 (0.999)	Thursday 0.0131
ARCH LM Test	(0.153)
0.8195	Friday 0.1338**
	(1.929)
	Diagnostics tests
	Ljung Box (12) Q stat.- levels
	5.910 (0.749)
	Ljung Box (12) Q stat.-squares
	2.032 (0.991)
	ARCH LM Test
	0.9591

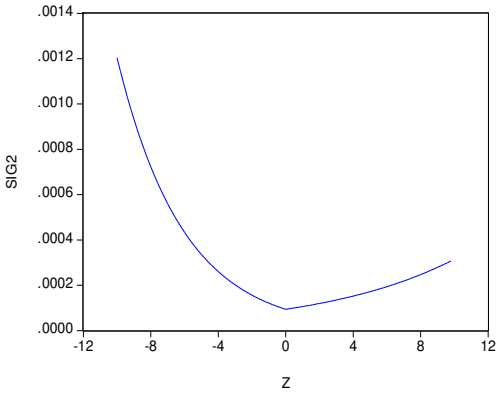
Z-statistics and probabilities are in parentheses for the return and volatility estimation and diagnostics tests respectively. (***) (**) (*) indicate the statistical level of significance at 1%, 5% and 10% respectively. . Rt (-1) indicates autocorrelation lags.

News Impact Curves Figure (2)

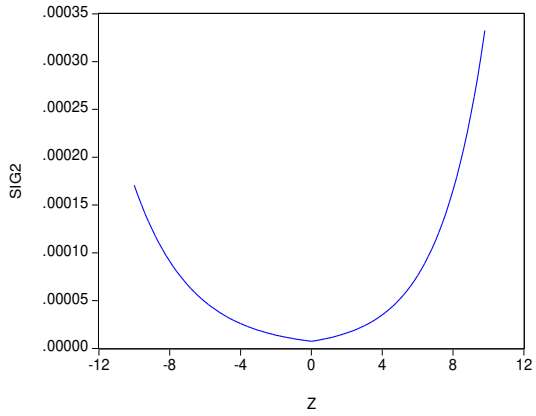
South Africa: pre-liberalisation (Daily) **-A**



South Africa: post-liberalisation (Daily) -**B**



Nigeria: post-liberalisation (Daily) -**C**



Figures 2 (a) to 2 (c) present the news impact curves (NICs) for daily stock returns for South Africa and Nigeria respectively. It usually plots the next period volatility (sig2) that would arise from various positive and negative values of the lagged residuals or shocks (Z) The vertical axis represents the level of current volatility while the horizontal axis represents the lagged residuals from the EGARCH model. The curves confirm that the bad news of the same magnitude resulted in more volatility in the two sample periods. The Nigerian daily data however, exhibits positive impact curve.

Figure 2 (A) is the South African daily return series (pre-liberalisation period) and it indicates that the lagged value of the shock or error ranging from -12 to 12. It further shows that the value of conditional variance is 0.0008 for a shock of -12 and 0.002 for a shock of 12. This clearly indicates that investors react more to negative news than positive news. Figure 2 (B) on the other hand is the South African daily return series (post-liberalisation) and it shows a conditional variance of 0.0012 for a shock of -12 and 0.002 for a shock of 12. This also shows that investors react more to negative news than to positive news. Figure 2 (C) depicts the Nigerian daily return series for post-liberalisation period with conditional variance of 0.00035 for a shock of 12. This clearly indicates that investors in the Nigerian equity market react more to positive news than the negative news and this is at odds with most empirical findings.

6 Conclusions

This study examines the day of the week effect for Nigerian and South African equity markets. It covers two periods: pre-liberalisation and post liberalisation, however, for Nigeria, the study covers only post-liberalisation period as there is no available data for the pre - liberalisation period. The paper uses an EGARCH model to estimate the day of the week effect in the mean and variance equations. In South Africa, there is significant evidence of the day of the week on Mondays and Fridays during the pre-liberalisation period but there is no day of week effect in the post-liberalisation period. The post liberalisation period of the Nigerian equity market also exhibits day of the week effect on Mondays and Tuesdays respectively.

References

Agathee, U. S. (2008) **"**Day of the Week Effects: Evidence from the Stock Exchange of Mauritius (SEM)" *International Research Journal of Finance and Economics* 17, 8-14

Aggarwal, R. and Rivoli (1989) "Seasonal and day-of-the week effect in four emerging stock markets" *Financial Review*, 24, pp. 541-550

Allen, G and D. Gale (2000), "Bubbles and Crises", *The Economic Journal*, 110, pp. 236-255.

Aly, H., Mehdian, S. and Perry, M. (2004) "An Analysis of the Day-of-the-Week Effects in the Egyptian Stock Market", *International Journal of Business*, 9, pp**:** 301-308.

Athanassakos, G., and Robinson, M. J. (1994). "The day-of-the-week anomaly: The Toronto stock exchange experience" *Journal of Business Finance and Accounting*, 21, pp. 833−856.

Basher, S. A. and Sadorsk, P. (2006) "Day-of-the-week effects in emerging stock markets, *Applied Economics Letters*, 13, pp. 621-628.

Bekaert, G. and C. Harvey (2000), "Foreign Speculators and Emerging Equity Markets", *The Journal of Finance*, 55, pp.565-613.

Bekaert, G; C.R. Harvey, and C.T. Lundblad (2003), "Equity Market Liberalization in Emerging Markets," *Journal of Financial Research*, 26, PP.275-299.

Bekaert, G. C.R. Harvey, and C. Lundblad (2005), "Does financial liberalization spur growth?" *Journal of Financial Economics*, 77, pp.3-55

Berument, H. and Kiymaz, H (2001) "The day of the week effect on stock market volatility" *Journal of Economics and Finance*, 25, pp.181- 193

Bhattacharya, U. and Hazem D. (2002) "The World Price of Insider Trading" *The Journal of Finance,* 57, pp. 75-108

Black, F. (1976), "Studies of Stock Price Volatility Changes", Proceedings of the American Statistical Association, Business and Economic Statistics Section, 177-181.

Brooks, C. and Persand G. (2001) "Seasonality in Southeast Asian stock markets: Some new evidence on day-of-the-week effects" Applied *Economics Letters*, 8, pp.155-158.

Cai, J., Li, Y., and Qi, Y. (2006). "The day-of-the-week effect: New evidence from the Chinese stock market" *The Chinese Economy*, 39, pp. 71−88.

Charles, A. (2010) "The day-of-the-week effects on the volatility: The role of the asymmetry" *European Journal of Operational Research*. 202, pp. 143–152

Christie, A.A. (1982), "The Stochastic Behaviour of Common Stock Variances: Value, Leverage and Interest Rate Effects", Journal of Financial Economics, 10, 407-432.

Chukwuogor, C. (2008) "An Econometric Analysis of African Stock Market: Annual Returns Analysis, Day-of-the-Week Effect and Volatility of Returns" *International Research Journal of Finance and Economics* 14, 370-378

Central Bank of Nigeria, (2004), "Nigeria: Major Economies, Finance and Banking Indicators"

Cross, F (1973) "The behaviour of stock prices on Fridays and Mondays" *Financial Analyst Journal*, 29, pp. 67-69

Dubois M, Louvet P. (1996) "The day-of-the-week effect: the international evidence" *Journal of Banking and Finance*, 20, pp.1463–84.

Engle, R. (1993). "Statistical models for financial volatility" *Financial Analysts Journal*, 72–78.

Fama, E. F. (1965) "The behaviour of stock market prices" *Journal of Business*, 38, pp. 34−105.

French, K. (1980) "Stock returns and the weekend effect" *Journal of Financial Economics*, 8, pp. 55-69

French. K.. Schwert. G. and Stambaugh. R. (1987). "Expected stock returns and volatility" *Journal of Financial Economics.* 19, pp.3-30

Fuchs-Schundeln, N. and N. Funke (2003) "Stock market liberalizations: Financial and macroeconomic implications" *Review of World Economics*, 139, pp 730-761
Gibbons, M. and Hess, P (1981) "Day of the week effects and asset returns" *Journal of Business,* 54, pp. 579-596

Hsieh, D. A. (1988) "The statistical properties of daily foreign exchange rates: 1974-1983" *Journal of International Economics*, 24, pp. 129-145

Hogholm, K. and Knif J. (2009) "The impact of portfolio aggregation on day-of-the-week effect: Evidence from Finland" *Global Finance Journal* 20, No.1, pp. 67–79

Hui, T. K. (2005). "Day-of-the-week-effects in US and Asia-Pacific Stock markets during the Asian financial crisis: a non-parametric approach" *Omega*, 33, pp. 277−282.

International Monetary Fund (2008), South Africa: Financial Stability Assessment, Including Report on the Observance of Standards and Codes on the following topic: Securities Regulation, Publication Services, Washington, D.C

Johannesburg Stock Exchange: Available at: http//ww.jse.co.za [accessed January 2010]

Junkus, J. C. (1986) "Weekend and day of the week effects in returns on stock index Futures" *The Journal of Futures Markets*, 6, pp.397−407.

Kato, K. (1990). "Weekday patterns in Japanese stock returns" *Management Science,* 36, pp. 1031−1043.

Kiyamaz, H. and Berument, H. (2003) "The day of the week effect on stock market volatility and volume: International evidence" *Review of Financial Economics*, 12, pp.363-380

Keim, B and Stambaugh, F., (1984) "A further investigation of the weekend effect in stock returns" *Journal of Finance*, 39, pp. 819-835.

Lakonishok, J. and Smidt, S. (1988). "Are seasonal anomalies real? A ninety-year Perspective" *Review of Financial Studies* 1, pp. 403–425.

Ndako U.B. (2010) "Financial development, economic growth and market volatility: Evidence from Nigeria and South Africa" PhD Thesis, University of Leicester, United Kingdom.

Ndako U. B. (2010) "Stock markets, Banks and Economic growth: Time series evidence from South Africa" *The African Finance Journal* 2, PP. 72- 92

Nelson, D.B. (1991). "Conditional Heteroskedasticity in Asset Returns: A New Approach" *Econometrica*, 59, pp. 347–370.

Nigerian Stock Exchange (2009). Available at: http://www.nigreianstockexchange.com [Accessed January 2010]

Osborne, M. F. M. (1962) "Periodic structure in the Brownian motion of the stock market" *Operations Research*, 10, pp. 345−379

Poshakwale, S., and Murinde, V. (2001). "Modeling the volatility in East European emerging stock markets: Evidence on Hungary and Poland" *Applied Financial Economics*, Vol.11, pp. No.4, 445−456.

Stiglitz, J.E. (2000), "Capital Market Liberalization, Economic Growth, and Instability", *World Development*, 28, pp. 1075-1086.

Singh, A. (1997), "Financial Liberalization, Stock markets and Economic Development", *The Economic Journal*, 107, pp. 771-782.

Tachiwou, A. M. (2010) "Day-of-the-Week-Effects in West African Regional Stock Market" *International Journal of Economics and Finance* 4, 167-173

World Bank (2007) *Making Finance Work for Africa* The International Bank for Reconstruction and Development/The World Bank. Available at: www.worldbank.org [Accessed August, 2010]

Yalcin, Y. and E.M. Yucel (2006) "The day-of –the week effect on stock market volatility and return: Evidence from Emerging Markets" *Czech journal of Economics and Finance*, 56, pp. 258-27