STOCK RETURN VOLATILITY, GLOBAL FINANCIAL CRISIS AND THE MONTHLY SEASONAL EFFECT ON THE NIGERIAN STOCK EXCHANGE

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Abstract

This paper investigated the monthly seasonal effect in the Nigerian stock market using the EGARCH-in-mean model in the light of banking reforms, insurance reform, stock market crash and the global financial crisis using daily returns over the period 4 January 2004 to March 2, 2009.The result shows the absence of monthly effect in stock returns but there exists the July and August effects in stock volatility. It is found that, in the Nigerian stock market, returns show persistence in the volatility and clustering and asymmetric properties. The results show that volatility is persistent and there is a leverage effect supporting the work of Nelson (1991). The study found little evidence on the relationship between stock returns and risk as measured by its own volatility.

***JEL**:* G01, G11, G12, G14.

***Key words**:* Month of the year effect, volatility, Stock market, Financial Reforms, Global Financial crisis, Volatility persistence, EGARCH-in-mean, Risk-return tradeoff.

1. INTRODUCTION

There have been several studies supporting capital market efficiency (see Fama (1965), Ball and Brown (1968), Fama and Blume (1966), Fama (1970), Fama, Fisher, Jensen and Roll (1969), Olowe (1999) among others). However, various studies have been done that are inconsistent with market efficiency. These studies show profitable investment opportunities and are referred to as anomalies (Olowe, 2009). The market anomalies show the existence of predictable behavior in stock returns may lead to profitable trading strategies, and in turn, abnormal returns. However, if the prediction about the as-

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set returns is realized, it becomes a debate for market efficiency. Some of the market anomalies that have attracted the attention of researchers are broadly known as seasonal effects. The most important seasonal effects studied are the day of the week effect, the day of the month effect, the month of the year effect or January effect, the trading month effect and the holiday effect. French (1980), Gibbons and Hess (1981), Keim (1983), Gultekin and Gultekin (1983), Harris (1986), Ariel (1987), Broca (1992) among others report these seasonal patterns.

Several studies have been conducted on the seasonal behavior of monthly stock market returns. These studies, also called the January effect or year-end effect or "tax loss selling" hypothesis, argued that investors, in order to reduce their taxes, sell their stocks in December (which is the tax month) to book losses. The selling of stocks by various investors will put downward pressure on the prices. As soon as December ends the market corrects and stock prices rise. The stocks will give a higher return in January. Wachtel (1942) was the first to point out the seasonal effect in the US markets. Rozeff and Kinney (1976), Gultekin and Gultekin (1983), Keim (1983), Reinganum (1983) among others also provided evidence supporting the January effect in the USA. Berges, McConnell, and Schlarbaum (1984) and Tinic, Barone-Adesi and West (1990) found the seasonal effect in Canada. The January effect has also been investigated emerging markets (Nassir and Mohammad, 1987; Ho, 1999; Fountas and Segerdakis, 1999; Kumar and Singh, 2008).

Most of the studies above have focused on seasonal patterns in mean return. An investor should be concerned not only with variations in asset returns, but also the variances in returns. Engle (1993) argues that risk-averse investors should reduce their investments in assets with higher return volatilities.

Engle (1982) introduced the autoregressive conditional heteroskedasticity (ARCH) to model volatility. Bollerslev (1986) generalized the ARCH model by modeling the conditional variance to depend on its lagged values as well as squared lagged values of disturbance, which is called generalized autoregressive conditional heteroskedasticity (GARCH). Since the work of Engle (1982) and Bollerslev (1986), the financial econometrics literature has been successful at measuring, modeling, and forecasting time-varying return volatility which has contributed to improved asset pricing, portfolio management, and risk management, as surveyed for example in Andersen, Bollerslev, Christoffersen and Diebold (2006a, 2006b).

An investigation of the monthly seasonal effect in returns should also consider the monthly seasonal effect on stock volatility. Several studies have been done using the GARCH framework to investigate the seasonal effect.

Berument and Kiymaz (2001) model seasonal effect using GARCH model. Their findings show that the seasonal effect is present in both volatility and return equations. Maghyereh (2003) using the standard GARCH, exponential GARCH (EGARCH) and the GJR models for Amman Stock Exchange (ASE) of Jordan found no evidence of monthly seasonality as well as the January effect in the ASE returns. Kumar and Singh (2008) employed the GARCH-in-mean model to study the volatility, risk premium and seasonality in risk-return relation of the Indian stock and commodity markets. They found the risk-return relationship to be positive though insignificant for Nifty and Soybean whereas a significant positive relationship is found in the case of Gold. They also found Seasonality in risk and return. Little or no work has been done on the monthly effect in stock returns, volatility and risk-return relationship in the Nigerian stock market particularly using GARCH models. The Nigerian stock market is increasingly becoming a "new market" for various investors. It would be interesting to study if some of the anomalies that have been proved for developed markets hold also for the Nigerian stock market.

The recapitalization of the banking industry in Nigeria in July 2004 and the Insurance industry in September 2005 boosted the number of securities in the Nigerian stock market increasing public awareness and confidence about the Stock market. The increased trading activity in the stock market could have affected its volatility. However, since April 1, 2008, investors have been worried about falling stock prices on the Nigerian stock market.

The global financial crisis of 2008, an ongoing major financial crisis, could have affected stock volatility. The crisis which was triggered by the subprime mortgage crisis in the United States became prominently visible on September 7, 2008 when the United States government took over two United States Government sponsored enterprises Fannie Mae (Federal National Mortgage Association) and Freddie Mac (Federal Home Loan Mortgage Corporation) into conservatorship run by the United States Federal Housing Finance Agency (Wallison and Calomiris, 2008; Labaton and Andrews, 2008). The crisis rapidly evolved into a global credit crisis, deflation and sharp reductions in shipping and commerce, resulting in a number of bank failures in Europe and sharp reductions in the value of equities (stock) and commodities worldwide.

The purpose of this paper is to investigate the monthly effect in stock returns, volatility and risk-return relationship in the Nigerian stock market using the EGARCH-in-mean model in the light of banking reforms, insurance reform, stock market crash and the global financial crisis. The rest of this paper is organised as follows: Section two discusses an overview of the Nigerian stock market, Financial Reforms, Stock market crash and the Global financial crisis while Section three discusses Theoretical background and literature. Section three discusses methodology while the results are presented in Section four. Concluding remarks are presented in Section five.

2. OVERVIEW OF THE NIGERIAN STOCK MARKET, FINANCIAL REFORMS AND THE GLOBAL FINANCIAL CRISIS

The Nigerian Stock Exchange (NSE) which started operation in 1961 with 19 securities has grown overtime. As of 1998, there were 264 securities listed on the NSE, made up of 186 equity securities and 78 debt securities. By 2008, the number of listed securities had increased to 301 securities made up of 213 equity securities and 88 debt securities. Table 1 highlights the trends in the number of listed securities on the Nigerian Stock market. Table 2 shows the trend in the trading transactions in the Nigerian stock market. Between 1980 and 1987, there was hardly any trading transaction on the equity market. Government and industrial loan stocks dominated the transactions on the Nigerian stock market (Olowe, 2008). Table 2 shows that the value of equity traded as a proportion of total value of all securities traded, equity traded as a proportion of total market capitalisation and equity traded as a proportion of GDP are all zero between 1980 and 1987. However, since 1988 the value of equity traded transaction has been increasing in the Nigerian stock market (Olowe, 2008). Table 2 shows that equity traded as a proportion of total value of all securities traded grew from 0.7348 in 1988 to 0.9988 in 1998 and to 0.9973 in 2007. Table 2 shows that between 1988 and 2005, the equity market is still small relative to the size of the stock market. The value of equity traded as a proportion of total market capitalisation was 0.0624 in 1988 but fell to 0.0022 in 1989. Since 1989, the value of equity traded as a proportion of total market capitalisation has been fluctuating rising slightly to 0.0516 in 1998, increasing to 0.1059 in 2004 and falling to 0.0878 in 2005. On July 4, 2004, Central Bank of Nigeria proposed banking reforms increasing the capitalisation of Nigerian banks to N25 billion. In the process of complying with the minimum capital requirement, N406.4 billion was raised by banks from the capital market, out of which N360 billion was verified and accepted by the CBN (Central Bank of Nigeria, 2005). The introduction of the 2004 bank capital requirements could have affected quoted securities on the Nigerian stock exchange. The recapitalisation of the Nigerian banking industry and influx of banking stocks into the Nigerian stock market made the value of equity traded as a proportion of total market capitalisation to increase to 0.1761 in 2008.

Table 2 shows that the stock market is small relative to the size of the economy. The value of equity traded as a proportion of GDP was 0.0023 in 1988 but fell to 0.0001 in 1989. Since 1989, the value of equity traded as a proportion of GDP has been fluctuating rising slightly to 0.0033 in 1998, increasing to 0.0192 in 2004 and falling to 0.0171 in 2005. The recapitalisation of the Nigerian banking industry which led to the influx of banking stocks into the Nigerian stock market made the value of equity traded as a proportion of GDP to increase to 0.0703 in 2008.

In sum, prior to 2004, the equity market appears to be small in Nigeria considering the low values of both the value of equity traded as a proportion of total market capitalisation and the value of equity traded as a proportion of GDP. Apart from the recapitalization of the Nigerian banking industry as earlier discussed, on September 5, 2005, the Federal Government of Nigeria introduced insurance industry reforms. The insurance industry reforms involve the recapitalization of Insurance and Reinsurance companies as: N2 billion for life insurance companies, N3 billion for non-life operators, N5 billion for composite insurance companies and N10 billion for re-insurers (NAICOM, 2008). In the process of complying with the minimum capital requirement, substantial money was raised by insurance companies from the capital market.

The introduction of the new capital requirements for banks in 2004 and insurance companies in 2005 with the prospect of an increase in volume of activities on the Nigerian stock market could have brightened the confidence of investors in the Nigerian economy and the stock market, thus, encouraging investment in capital market securities and increasing capital formation. They could also have affected the volatility of the stock market.

The Nigerian Stock Exchange index has grown overtime. The index grew from 134.6 on January 1986 to 65005.48 by March 18, 2008 falling to 63016.56 by April 1, 2008. Since April 1, 2008, Nigerian stock exchange index has been falling. As at March 2, 2009, the Nigerian stock exchange index stood at 27108.54. Figure 1 shows the trend in the Nigerian Stock Exchange index over the period January 1986 to December 2008. The crash in the stock market prices from April 2008 could be seen from Figure 1.

The crash in the stock market prices in the Nigerian stock market could have been aided by the global financial crisis of 2008. The global crisis which was caused by the crisis in the subprime mortgage market in the United States became prominently visible in September 2008 with the failure, merger, or conservatorship of several large United States-based financial firms exposed to packaged subprime loans and credit default swaps issued to insure these loans and their issuers. On September 7, 2008, the United States gov-

Table 1: Number of Securities Listed on the Nigerian Stock Exchange, 1980-2008

Year	Equity Securities	Debt Securities	Total
1980	91	66	157
1981	93	70	163
1982	93	75	168
1983	93	86	179
1984	94	83	177
1985	96	85	181
1986	99	87	186
1987	100	85	185
1988	102	86	188
1989	111	87	198
1990	131	86	217
1991	142	97	239
1992	153	98	251
1993	174	98	272
1994	177	99	276
1995	181	95	276
1996	183	93	276
1997	182	82	264
1998	186	78	264
1999	196	73	269
2000	195	65	260
2001	194	67	261
2002	195	63	258
2003	200	65	265
2004	207	70	277
2005	214	74	288
2006	202	86	288
2007	212	98	310
2008	213	88	301

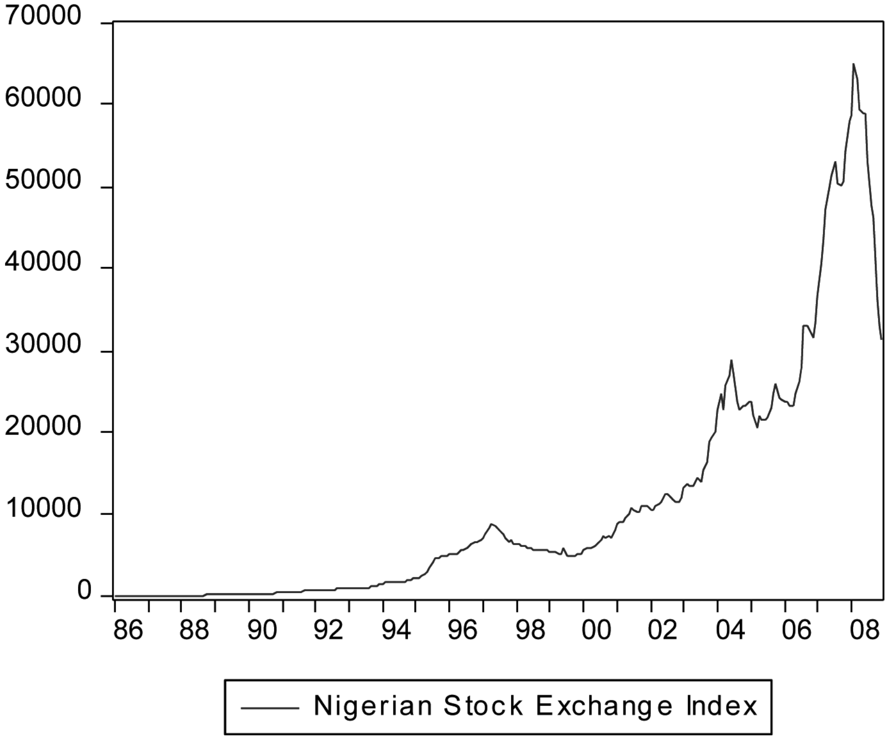
Source: The Nigerian Stock Exchange

Table 2: Trading Transactions on the Nigerian Stock Exchange

Year	Govt. Securities and Industrial Loan	Equities	Total	ET/TVT	ET/TMC	ET/GDP
1980	388.7	-	388.7	0	0	0
1981	304.8	-	304.8	0	0	0
1982	215	-	215	0	0	0
1983	397.9	-	397.9	0	0	0
1984	256.5	-	256.5	0	0	0
1985	316.6	-	316.6	0	0	0
1986	497.9	-	497.9	0	0	0
1987	382.4	-	382.4	0	0	0
1988	225.5	624.8	850.3	0.7348	0.0624	0.0023
1989	582.4	27.9	610.3	0.0457	0.0022	0.0001
1990	158.5	66.9	225.4	0.2968	0.0041	0.0001
1991	98.7	143.4	242.1	0.5923	0.0062	0.0003
1992	91.7	400	491.7	0.8135	0.0128	0.0004
1993	348.2	456.2	804.4	0.5671	0.0096	0.0004
1994	192.3	793.6	985.9	0.8050	0.0120	0.0005
1995	50.8	1,788.00	1,838.80	0.9724	0.0099	0.0006
1996	62.8	6,916.80	6,979.60	0.9910	0.0242	0.0017
1997	107.9	10,222.60	10,330.50	0.9896	0.0363	0.0036
1998	15.8	13,555.30	13,571.10	0.9988	0.0516	0.0050
1999	0.8	14,071.20	14,072.00	0.9999	0.0469	0.0044
2000	8.1	28,145.00	28,153.10	0.9997	0.0596	0.0061
2001	35.6	57,648.20	57,683.80	0.9994	0.0870	0.0122
2002	2.6	59,404.10	59,406.70	1.0000	0.0777	0.0086
2003	6520.1	113,882.50	120,402.60	0.9458	0.0838	0.0134
2004	2047.5	223,772.50	225,820.00	0.9909	0.1059	0.0196
2005	8252.7	254,683.10	262,935.80	0.9686	0.0878	0.0175
2006	1665	468,588.40	470,253.40	0.9965	0.0915	0.0252
2007	1136.5	1,074,883.90	1,076,020.40	0.9989	0.0809	0.0520
2008	3528.9	1,675,609.80	1,679,138.70	0.9979	0.1761	0.0703

Source: Central Bank of Nigeria Annual Report and Accounts, Various issues.
Notes: ET represents value of equity securities traded. TVT represents total value of all securities traded. TMC represents Total market capitalisation. GDP represents Gross domestic prices at current prices.

Figure 1: Trend in the Nigerian Stock Exchange Index over the period, January 1986 to December, 2008



ernment took over two United States Government sponsored enterprises Fannie Mae (Federal National Mortgage Association) and Freddie Mac (Federal Home Loan Mortgage Corporation) into conservatorship run by the United States Federal Housing Finance Agency (Wallison and Calomiris, 2008; Labaton and Andrews, 2008). The two enterprises as at that time owned or guaranteed about half of the U.S.'s $12 trillion mortgage market. This caused panic because almost every home mortgage lender and Wall Street bank relied on them to facilitate the mortgage market and investors worldwide owned $5.2 trillion of debt securities backed by them. Later in that month Lehman Brothers and several other financial institutions failed in the United States (Labaton, 2008). The crisis rapidly evolved into a global credit crisis, deflation and sharp reductions in shipping and commerce, resulting in a number of bank failures in Europe and sharp reductions in the value of equities (stock) and commodities worldwide. In the United States, 15 banks failed in 2008, while several others were rescued through government intervention or acquisitions by other banks (Letzing, 2008). The financial crisis created risks to the broader economy which made central banks around the world to cut interest rates and various governments implement economic stimulus packages to stimulate economic growth and inspire confidence in the financial markets. The financial crisis dramatically affected the global stock markets. Many of the world's stock exchanges experienced the worst declines in their history, with drops of around 10% in most indices (Kumar, 2008). In the US, the Dow Jones industrial average fell 3.6%, not falling as much as other markets (Cox, 2008). The economic crisis caused countries to temporarily close their markets. As of September 5, 2008, the Nigerian stock exchange index stood at 49615.55 having fallen from 63016.56 as at April 1, 2008. It appears the crash in the stock market prices to 27108.54 as of March 2, 2009 could have been aided by the global financial crisis.

3. LITERATURE REVIEW

The month-of-the-year effect in stock market returns has been widely documented in finance literature. The month-of-the-year effect is present when returns in some months are higher than other months. In the USA and some other countries, December is the year-end month and also the tax month. It is argued that investors will sell shares that have lost values in December in order to reduce their taxes. The sale by various investors will put a downward pressure on the share prices and thus lowers stock returns. As soon as the tax month (December) ends, investors start buying shares in January and share prices will start rising. This will cause stock returns to be high in the month of January. This tax-loss selling hypothesis has been found to be consistent with the 'year-end' effect and the 'January effect' in stock returns by various studies (Kumar and Singh, 2008; Bepari and Mollik, 2009). Wachtel (1942) was the first to point out the seasonal effect in the US stock markets. Some other studies in the USA supporting this effect include Rozeff and Kinney (1976), Keim (1983) and Reinganum (1983). Rozeff and Kinney (1976) found that stock returns in January to be larger than in other months. Keim (1983) found that small firm returns were significantly higher than large firm returns during the month of January. Reinganum (1983), however, found that the tax-loss-selling hypothesis could not explain the entire seasonality effect.

Apart from the USA studies, evidence of seasonal effect has been found in other developed countries. Gultekin and Gultekin (1983) examined data of 17 industrial countries with different tax laws and confirmed the January effect. Berges, McConnell, and Schlarbaum (1984) and Tinic, Barone-Adesi and West (1990) found seasonal effect in Canada. Boudreaux (1995) found the presence of the month-end effect in markets in Denmark, Germany and Norway. The seasonal effect in stock returns has also been found in UK (Lewis, 1989), Australia (Officer, 1975; Brown, Keim, Kleidon and Marsh, 1983) and Japan (Aggarwal, Rao and Hiraki, 1990). Raj and Thurston (1994) investigated the January and April effects in the New Zealand stock market and found no significant effect.

The month of the year effect in stock returns has also been investigated for some emerging markets. Nassir and Mohammad (1987) investigated the January effect in Malaysia and found the average January returns to be significantly positive and higher than in other months. Ho (1999) found that six out of eight emerging Asian Pacific stock Markets exhibit significantly higher daily returns in January than in other months. Fountas and Segerdakis (1999) investigated the January effect using monthly stock returns in eighteen emerging stock markets and found very little evidence in favor of this effect in the emerging markets. Pandey (2002) and Lazar et al.(2005) using data from Bombay Stock Exchange's Sensitivity Index examined the monthly effect in the stock returns in India. They found the existence of seasonality in stock returns in India consistent with the 'tax-loss selling' hypothesis. Alagidede and Panagiotidis (2006) in a Ghanian study examined both the day of the week and month of the year in the stock returns employing rolling techniques to assess the effects of policy and institutional changes thereby allowing deviations from the linear paradigm. They found an April effect for Ghana's stock market. Al- Saad and Moosa (2005) examined the monthly seasonal effect in Kuwait by applying structural time series model incorporating stochastic dummies. They found a July effect for Kuwait Stock Exchange. Bepari and Mollik (2009) investigated the existence of seasonality in return series of Dhaka Stock Exchange (DSE) of Bangladesh. They found an April effect in DSE.

Ayadi, Dufrene and Chatterjee (1998) conducted an anomalous turn-of-the-year study of stock return seasonalities in low-income African emerging markets using monthly market indices for the Ghanaian stock market, Nigerian stock market, and Zimbabwean stock market Their results, using Kruskal-Wallis and Friedman tests, suggest the absence of seasonality in stock returns on the Nigerian and Zimbabwean stock markets while the Friedman test confirms the presence of seasonality in stock returns for Ghana. Furthermore, the Wilcoxon-Mann-Whitney test and the dummy-variable regression analysis show the presence of the "January effect" for Ghana but not for Nigeria and

Zimbabwe. Chukwuogor (2008) investigated the presence of day-of-the-week effect, returns volatility and analyzes the annual returns of five African stock markets. His results, using Kruskal-Wallis test, do not support the existence of the day-of-the-week effect on stock returns in the five stock indexes of Botswana, Egypt, Ghana, Nigeria and South Africa.

Most of the studies above have focused on seasonal pattern in mean return. An investor should be concerned not only with variations in asset returns, but also the variances in returns. Engle (1993) argues that risk-averse investors should reduce their investments in assets with higher return volatilities.

Engle (1982) introduced the autoregressive conditional heteroskedasticity (ARCH) to model volatility. Engle (1982) modeled the heteroskedasticity by relating the conditional variance of the disturbance term to the linear combination of the squared disturbances in the recent past. Bollerslev (1986) generalized the ARCH model by modeling the conditional variance to depend on its lagged values as well as squared lagged values of disturbance, which is called generalized autoregressive conditional heteroskedasticity (GARCH). Since the work of Engle (1982) and Bollerslev (1986), the financial econometrics literature has been successful at measuring, modeling, and forecasting time-varying return volatility which has contributed to improved asset pricing, portfolio management, and risk management, as surveyed for example in Andersen, Bollerslev, Christoffersen and Diebold (2006a, 2006b). Financial series sometimes show asymmetric properties, when the conditional variance tends to respond asymmetrically to positive and negative shocks in errors. The popular models of asymmetric volatility includes, the exponential GARCH (EGARCH) model (Nelson, 1991), Glosten, Jogannathan, and Rankle (1992) GJR-GARCH model, Zakoian (1994) threshold ARCH (TARCH) etc.

If investors can identify a certain pattern in volatility, then it would be easier to make investment decisions based on both return and risk (Kiymaz and Berument, 2003). Thus, an investigation of the seasonal effect in returns should also consider the seasonal effect on stock volatility. Several studies have been done using the GARCH framework to investigate the seasonal effect. Berument and Kiymaz (2001) model the seasonal effect using the GARCH model. Their findings show that the day of the week effect is present in both volatility and return equations. Maghyereh (2003) using the standard GARCH, exponential GARCH (EGARCH) and the GJR models examined the seasonality of monthly stock returns as well as the January effect in the Amman Stock Exchange (ASE) of Jordan. He found no evidence of monthly seasonality as well as a January effect in the ASE returns. Kumar and Singh (2008) employed the GARCH-in-mean model to study the volatility, risk premium and seasonality in risk-return relation of the Indian stock and commodity markets. They found risk-return relationship to be positive though insignificant for Nifty and Soybean whereas a significant positive relationship is found in the case of Gold. They also found Seasonality in risk and return. Some other studies on the seasonal effect using different variations of the GARCH model include Miralles and Miralles (2000), Choudhry (2000), Amigo and Rodríguez (2001), Balaban, Bayar and Kan (2001), Kiymaz and Berument (2003), Yalcin and Yucel (2006), Chandra (2004), Apolinario, Santana, Sales and Caro (2006) among others.

Little or no work has been done on the monthly effect in stock returns, volatility and risk-return relationship in the Nigerian stock market particularly using GARCH models. Ayadi, Dufrene and Chatterjee (1998) investigated the monthly effect in stock returns in Nigeria using monthly data and their results could have been affected by the financial reforms and the global financial crisis. Their results could also have been affected if a high frequency data has been used. Furthermore, they did not use GARCH model. This paper attempts to fill this gap.

4. METHODOLOGY

4.1 The data

The time series data used in this analysis consists of daily Nigerian Stock Exchange index from January 2, 2004 to March 13, 2009 obtained from the Nigerian Stock Exchange. In this study, stock return is defined as:

$$R_t = \log\left(\frac{NSI_t}{NSI_{t-1}}\right) \quad (1)$$

where

R_t represent stock return at day t

NSI_t mean Nigerian Stock Exchange index at day t

NSI_{t-1} represent Nigerian Stock Exchange index at day t-1.

The R_t of Equation (1) will be used in investigating the volatility of stock returns and month of the year effect in stock return in the Nigerian stock market over the period, January 2, 2004 to March 2, 2009.

This paper will investigate the impact of the Financial reforms (banking and insurance reforms), stock market crash and the global financial crisis on the stock market returns, stock volatility and in the investigation of the month of the year effect in stock returns.

Financial Reform variables

The first financial reform is the introduction of new capital requirements of N25 billion for banks in July 2004 defined as BR. The value 0 is entered for the days before July 4, 2004 and 1 for other days.

The second financial reform is the introduction of new capital requirements for Insurance companies in September 5, 2005 defined as ISR. The value 0 is entered for the days before September 5, 2005 and 1 for other days.

Stock market crash variable

Since April 1, 2008, stock prices on the Nigerian Stock market has been declining. The stock index fell from 63016.56 on April 1, 2008 to 27108.4 on March 2, 2009. To account for the stock market crash (SMC) in this paper, a dummy variable is set equal to 0 for the period before April 1, 2008 and 1 thereafter.

Global Financial Crisis variable

In this study, September 7, 2008 is taken as the date of commencement of the global financial crisis. On this day, the United States government took over two United States Government sponsored enterprises - Fannie Mae (Federal National Mortgage Association) and Freddie Mac (Federal Home Loan Mortgage Corporation) into conservatorship run by the United States Federal Housing Finance Agency. The global financial crisis (GFC) will be accounted for in this paper by setting a dummy variable equal to 0 for the days before September 7, 2008 and 1 thereafter.

4.2 Properties of the data

Table 3 reports the preliminary statistics (evidence) for the returns for the entire study period as well as the return for each month of the year. The average return for the entire study period is 0.0001. The standard deviation of the return is 0.0923, and the skew is -0.0251. The kurtosis is 615.4200 which is much larger than 3, the kurtosis for a normal distribution. The Jarque-Berra normality test rejects the normality of returns at the 5 percent level. The negative skew is an indication of a non-symmetric series. Figure 2 clearly show that the distribution of the stock return series show a strong departure from normality.

When the return of each month is analyzed in Table 3, the findings indicate that December has a mean return of 0.08 percent, while January has a mean return of - 0.012 percent. The signs of the findings are inconsistent with

Table 3: Summary Statistics of the Daily Stock returns Return Series stratified monthly over the period, January 2, 2004 - March 2, 2009

	Mean	Median	Max.	Min.	SD	Skewness	Kurtosis	Jarque-Bera		N
								Statistic	Probability	
Jan	-0.0016	-0.0000	0.0194	-0.0606	0.0115	-1.6824	8.4522	203.5282	(0.0000)*	119
Feb	0.0027	0.0017	0.0297	-0.0283	0.0113	0.1802	3.1872	0.8246	(0.6621)	120
Mar	-0.0015	-0.0001	0.0182	-0.0301	0.0077	-1.1938	6.4048	74.9397	(0.0000)*	104
Apr	0.0021	0.0000	0.0280	-0.0175	0.0086	0.8836	4.0685	16.3484	(0.0003)*	92
May	0.0016	-0.0000	0.0538	-0.0383	0.0098	1.0934	11.9021	360.6241	(0.0000)*	103
Jun	0.0011	-0.0000	0.0707	-0.0513	0.0155	0.9000	9.1264	176.6786	(0.0000)*	104
Jul	-0.0004	-0.0000	0.0204	-0.0325	0.0076	-0.8736	5.7711	48.2917	(0.0000)*	108
Aug	-0.0006	-0.0014	0.0383	-0.0406	0.0158	0.0651	3.3248	0.5713	(0.7515)	112
Sep	-0.0002	-0.0000	2.3040	-2.3053	0.3197	-0.0043	52.4118	10681.6700	(0.0000)*	105
Oct	-0.0015	-0.0000	0.0274	-0.0361	0.0092	-1.2002	8.2806	143.0014	(0.0000)*	102
Nov	-0.0012	-0.0000	0.0224	-0.0566	0.0114	-1.2806	7.9219	132.1146	(0.0000)*	103
Dec	0.0008	-0.0000	0.0292	-0.0249	0.0100	-0.1253	3.8331	2.9956	(0.0000)*	95
All	0.0001	-0.0000	2.3040	-2.3053	0.0923	-0.0251	615.4200	19799951	(0.0000)*	1267

Notes: p values are in parentheses. * indicates significance at the 5% level. Max denotes maximum. Min. denotes minimum. SD denotes Standard deviation. N denotes number of observations.

the results of Cross 1973; Lakonishok and Levi 1982; Rogalski 1984; Keim and Stambaugh 1984; Harris 1986a, 1986b). The lowest return of -0.015 percent is observed for March while the highest return of 0.27 percent is observed for February. This finding is consistent with the result obtained by Kiymaz andBerument (2003) for the United States. The lowest standard deviation of 0.0077 is observed for July while the highest standard deviation of 0.3197 is observed for September. February, April, May, June and August have positive skew while all other months have negative skew. Thus, the impact of the negative skew is predominant. The skewness of the data indicates a possible non-symmetric series.

The kurtosis for each month is larger than 3, the kurtosis for a normal distribution. The Jarque-Bera normality test accepts the hypothesis of normality for February and August while for all other months, rejects the Jarque-Bera test rejects the hypothesis of normality. Thus, on average, the distribution of the stock return series is not normal.

The Ljung-Box test Q statistics as reported in Table 4 are all significant at the 5% for all reported lags confirming the presence of autocorrelation in the stock returns return series. The Ljung-Box test Q^2 statistics for are all significant at the 5% for all reported lags confirming the presence of heteroscedasticity in the stock returns return series.

Table 5 shows the results of unit root test for the stock returns return series. The Augmented Dickey-Fuller test and Phillips-Perron test statistics for the stock returns return series are less than their critical values at the 1%, 5% and 10% levels. This shows that the stock returns return series has no unit root. Thus, there is no need to differentiate the data.

In summary, the analysis of the stock return series indicates that the empirical distribution of returns in the stock returns market is non-normal, with very thick tails. The leptokurtosis reflects the fact that the market is characterised by very frequent medium or large changes. These changes occur with greater frequency than what is predicted by the normal distribution. The empirical distribution confirms the presence of a non-constant variance or volatility clustering.

Table 4: Autocorrelation of the Raw Stock returns Return Series over the period, January 2, 2004 - March 2, 2009

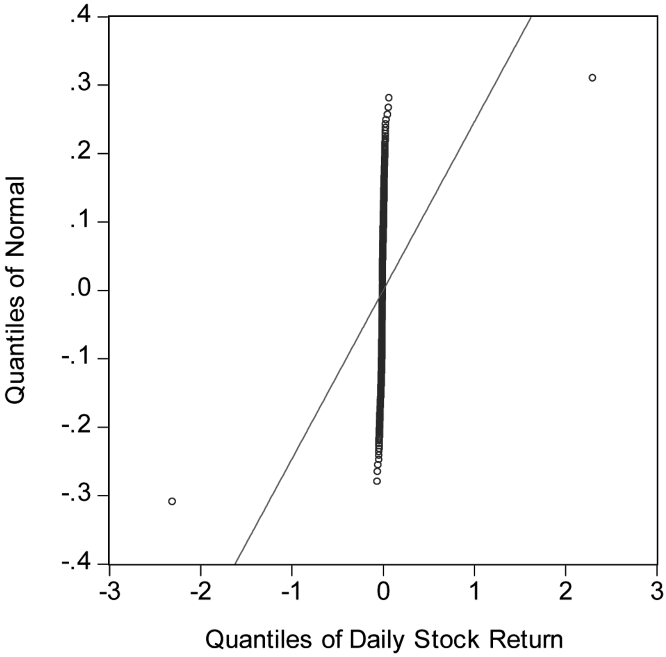
	Lags			
	1	6	12	20
Ljung-Box Q Statistics	300.1900	300.2100	300.3300	300.4500
	(0.0000)*	(0.0000)*	(0.0000)*	(0.0000)*
Ljung-Box Q^2 Statistics	316.4700	316.4800	316.5000	316.5300
	(0.0000)*	(0.0000)*	(0.0000)*	(0.0000)*

Notes: p values are in parentheses. * indicates significance at the 5% level.

Table 5: Unit Root Test of the Stock returns Return Series over the period, January 2, 2004 - March 2, 2009

	Statistic	**Critical Values**		
		1% level	5% level	10% level
Augmented Dickey-Fuller test	-22.0953	-2.5668	-1.9411	-1.6165
Philips-Perron test	-104.5101	-2.5668	-1.9411	-1.6165

Figure 2: Quantile-Quantile Plot of Stock returns Return Series over the period, January 2, 2004 - March 2, 2009



4.3 Models used in the study

This paper investigates the month of the year effect in returns in the light of banking reforms, insurance reform, stock market crash and the global financial crisis. This paper will preliminarily employ the standard methodology used in investigating seasonality in monthly returns by estimating an OLS regression with dummies to capture month of the year effects as follows:

$$R_t = b_0 + \sum_{j=1}^{K} d_j R_{t-1} + \sum_{j=1}^{11} b_j \delta_{jt} + \varepsilon_t \tag{2}$$

R_t is the return on day t as shown in (1). The δ_{jt} are dummy variables representing the month of the year j in day t such that δ_{jt} =1 if day t is January and zero otherwise; δ_{2t} =1 if day t is February and zero otherwise and so forth. The OLS coefficients b_1 to b_{11} are the mean returns for January through November respectively and ε_t is the stochastic term. December dummy variable is excluded to avoid a dummy variable trap. The intercept term b_0 indicates mean return for the month of December and coefficients $b_1 \ldots b_{11}$ represent the average differences in return between December and each other month. These coefficients should be equal to zero if the return for each month is the same and if there is no seasonal effect. Thus, the presence of month of the year effect implies:

$$H_0 : b_1 = b_2, \ldots, b_{11} = 0 \text{ against } H_1 : b_1 \neq b_2, , \ldots, b_{11} \neq 0 \tag{3}$$

In view of the autocorrelation in the stock returns series, the number of lags in Equation (2) will be selected in such a way as to eliminate autocorrelations in the stock return series. The optimum lag length of 9 (K=9) for the stock returns in Equation (2) was chosen on the basis of Akaike information Criterion.

Stock Returns, Financial Reforms, Stock market crash and the global financial crisis

The impact of banking reforms, insurance reform, the stock market crash and the global financial crisis on stock returns was first tested by estimating OLS regression as follows:

$$R_t = b_0 + \sum_{j=1}^{K} d_j R_{t-j} + g_1 BR + g_2 ISR + g_3 SMC + g_4 GFC + \varepsilon_t \tag{4}$$

The optimum lag length of 9 (K=9) for the stock returns in Equation (4) was also chosen on the basis of Akaike information Criterion. BR and ISR are expected to have a positive impact on stock returns because banking and insurance reforms are expected to boost the number of securities in the Nigerian stock market. The stock market crash (SMC) and global financial crisis (GFC) are expected to have a negative impact on stock returns.

Stock Returns, Financial reforms, Stock market crash, the global financial crisis and the month of the year effect

The impact of the banking reforms, insurance reform, the stock market crash and the global financial crisis on the month of the year effect in returns estimated in Equation (2) is investigated by estimating OLS regression as follows:

$$R_t = b_0 + \sum_{j=1}^{K} d_j R_{t-j} + \sum_{j=1}^{11} b_j \delta_{jt} + g_1 BR + g_2 ISR + g_3 SMC + g_4 GFC + \varepsilon_t \quad (5)$$

The optimum lag length of 9 (K=9) for the stock returns in Equation (5) was also chosen on the basis of Akaike information Criterion.

Stock Returns, Volatility, Banking reform, Insurance reform, Stock market crash, the global financial crisis and the month of the year effect

A drawback of using Equations (2) and (5) is that the error variances may not be constant over time, resulting in inefficient estimates if there is a time varying variance. The drawback is resolved by making the variance time varying, that is, employing GARCH models. Due to the possible non-symmetric property of the stock return series, this paper employs the exponential GARCH (EGARCH) model advanced by Nelson (1991). This study uses the EGARCH-in-Mean model to study the month-of-the-year effect on stock returns and volatility in Nigeria in the light of banking reforms, insurance reform, the stock market crash and the global financial crisis. The mean and variance equations that will be used are given as:

$$R_t = b_0 + \sum_{j=1}^{K} b_j \delta_{jt} + dR_{t-1} + f\sigma_t + g_1 BR + g_2 ISR + g_3 SMC + g_4 GFC + \varepsilon_t$$

$$\varepsilon_t / \phi_{t-1} \sim N(0, \sigma_t^2, \nu_t) \quad (6)$$

$$\log(\sigma_t^2) = \omega + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} - \sqrt{\frac{2}{\pi}} \right| + \beta_1 \log(\sigma_{t-1}^2) + \gamma \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| \quad (7)$$

Where δ_{jt} are dummy variables as discussed in Equation (2) representing month of the year j in day t. δ_{1t}, δ_{2t}, δ_{3t}, δ_{4t}, δ_{5t}, δ_{6t}, δ_{7t}, δ_{8t}, δ_{9t}, δ_{10t} and δ_{11t} represent January, February, March, April, May, June, July, August, September, October and November respectively. R_t represents stock returns at time t. The optimum lag length for the stock returns in Equation (6) was chosen, using the approach of Equation (2), on the basis of Akaike information Criterion. σ_t represents the conditional standard deviation at time t. f measures the risk-return tradeoff. g_1, g_2, g_3 and g_4 represent the impact of the banking reform (BR), insurance reform (ISR), stock market crash (SMC) and global financial crisis (GFC) on stock return respectively. ε is an error term assumed to follow a conditional student t distribution with v degrees of freedom. If $\gamma < 0$ it can be interpreted as evidence of stock market asymmetric behavior.

As earlier discussed for Equation (2), the intercept term b_0 indicates mean return for the month of December and coefficients $b_1 \ldots b_{11}$ represent the average differences in return between December and each other month. Thus, b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9, b_{10} and b_{11} represent January effect, February effect, March effect, April effect, May effect, June effect, July effect, August effect, September effect, October effect and November effect respectively on stock returns.

To account for the impact of the month of the year effect on volatility and shift in variance as a result of the banking reforms, insurance reforms, the stock market crash and the global financial crisis, the EGARCH-M model of Equations (6) and (7) is re-estimated with the mean equation (6) while the variance equation is augmented as follows:

$$\log(\sigma_t^2) = \omega + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} - \sqrt{\frac{2}{\pi}} \right| + \beta_1 \log(\sigma_{t-1}^2) + \gamma \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \sum_{j=1}^{11} h_j \delta_{jt}$$

$$+ \Theta_1 BR + \Theta_2 ISR + \Theta_3 SMC + \Theta_4 GFC \quad (8)$$

$h_1 \ldots h_{11}$ represent size and direction of the effect of each month of the year on stock volatility. In other words, h_1, h_2, h_3, h_4, h_5, h_6, h_7, h_8, h_9, h_{10} and h_{11} represent January effect, February effect, March effect, April effect, May effect, June effect, July effect, August effect, September effect, October effect and November effect respectively on volatility. Banking reform and insurance reform are expected to have a negative impact on volatility while the stock market crash and global financial crisis are expected to have a positive impact on volatility.

The volatility parameters to be estimated include ω, α, β and γ. As the stock returns return series shows a strong departure from normality, all the models will be estimated with Student t as the conditional distribution for errors. The estimation will be done in such a way as to achieve convergence.

4. THE RESULTS

The results of estimating the OLS regression Equation (2) are presented in Table 4. The results of Equation (2) shows that only coefficient d_9 is insignificant out of the 9 lags added to correct for autocorrelation in the stock return series. The rest are all significant at the 5% level. This confirms the correctness of adding the variables to correct for autocorrelation in the stock return series. The coefficients b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9, b_{10} and b_{11} representing January effect, February effect, March effect, April effect, May effect, June effect, July effect, August effect, September effect, October effect and November effect respectively on stock returns are statistically insignificant at the 5% level. This appears to imply that monthly seasonal effect in stock returns is not present in Nigeria. The hypothesis of Equation (3) was further tested using Wald tests. The result of Wald test for Equation (2) as shown in Table 4 further shows that seasonal effect in stock returns is not present in Nigeria. The F statistic and Durbin Watson statistic show a good fit for Equation (2).

The results of estimating the OLS regression Equation (4) to investigate the impact of banking reform, insurance reform, the stock market crash and the global financial crisis on stock returns are presented in Table 4. The results of Equation (4) shows that all the 9 lags added to correct for autocorrelation in the stock return series are significant at the 5% level confirming the correctness of adding the variables to correct for autocorrelation in the stock return series. The result of Equation (4) shows that the coefficient g_1 (coefficient of the banking reform) is negative and statistically insignificant at the 5% level but significant at the 10% level. This implies that the new bank capital requirement announced in 2004 appears to have little impact on stock returns. The result of Table 4 further shows that coefficient g_2 (coefficient of the insurance reform) is statistically insignificant at the 5% level but significant at the 10% level. This implies that the new capital requirement of insurance companies announced in 2005 has little or no impact on stock returns. The coefficient g_3 (coefficient of stock market crash) is negative and statistically significant at the 5% level and the augmented model. This shows that the stock market crash since April 2008 negatively impacts on stock returns in Nigeria. The coefficient g_4 (coefficient of global financial crisis) is statistically insignificant at the 5% level but significant at the 10% level implying that the global financial crisis has no impact on stock returns in Nigeria. The F statistic and Durbin Watson statistic show a good fit for Equation (4).

The results of estimating the OLS regression Equation (5) showing the joint test of the impact of month-of-the-year effect, banking reform, insurance reform, the stock market crash the global financial crisis on stock returns are presented in Table 4. Just as in Equation (4), the results of Equation (5) shows that all the 9 lags added to correct for autocorrelation in the stock return series are significant at the 5% level confirming the correctness of adding the variables to correct for autocorrelation in the stock return series. As in Equation (2), the coefficients b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9, b_{10} and b_{11}

representing January effect, February effect, March effect, April effect, May effect, June effect, July effect, August effect, September effect, October effect and November effect respectively on stock returns are statistically insignificant at the 5% level. This also appears to imply that monthly seasonal effect in stock returns is not present in Nigeria. The result of Wald test for Equation (5) as shown in Table 4 further shows that seasonal effect in stock returns is not present in Nigeria. The results of Equation (5) for g_1, g_3 and g_4 representing coefficients of banking reform, the stock market crash and global financial crisis are similar as in Equation (4). g_1 and g_4 are insignificant at the 5% level while g_3 is significant at the 5% level. However, unlike Equation (4), g_2 representing coefficient of insurance reform is positive and statistically significant at the 5% level. In both Equations (2) and (5), g_2, g_3 and g_4 carry the right sign while g_1 carries the wrong sign. The F statistic and Durbin Watson statistic show a good fit for Equation (5).

4.1 Stock Return, Volatility, Month-of-the-Year effect, Banking Reform, Insurance Reform, Stock market Crash and the Global Financial Crisis

The results of estimating the EGARCH-in-Mean models as stated in Section 4.3 for the EGARCH-M (1,1) and Augmented EGARCH-M(1,1) models are presented in Table 5. In the mean equation, d_1 (coefficient of lag of stock returns) is significant in the EGARCH-M model and the augmented model confirming the correctness of adding the variable to correct for autocorrelation in the stock return series. The mean equation further shows that f (the coefficient of expected risk) is positive and insignificant in the EGARCH-M model and the augmented model. This shows that there is little evidence on the statistical relationship between stock return and its own volatility. In other words, conditional standard deviation weakly predicts power for stock returns. The result is consistent with the work of French et al. (1987), Baillie and DeGennaro (1990), Chan et al. (1992), Leon (2007) and Kumar and Singh (2008). The coefficient g_1 (coefficient of the banking reform) in the mean equation is negative and statistically significant at the 5% level as reported in the EGARCH-M model but insignificant in the augmented model. However, g_1 is negative and statistically significant at the 10% level in the augmented model. The result of insignificant g_1 as obtained in the augmented model is similar to the results in Table 4. This implies that the new bank capital requirement announced in 2004 appears to have little or no impact on stock returns. The result of Table 5 further shows that coefficient g_2 (coefficient of the insurance reform) in the mean equation is statistically insignificant at the 5% level as reported in the EGARCH-M model and the augmented model. This implies that the new capital requirement of insurance companies announced in 2005 has no impact on stock returns. The results of g_3 and g_4 are similar to the results in Table 4. The coefficient g_3 (coefficient of stock market crash) is negative and statistically significant at the 5% level in the EGARCH-M model and the augmented model. This shows that the stock market crash since April 2008 negatively impacts on stock returns in Nigeria. The coefficient g4 (coefficient of global financial crisis) is statistically insignificant in the EGARCH-M model and the augmented model implying that the global financial crisis has no impact on stock returns in Nigeria.

The coefficients b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9, b_{10} and b_{11} representing January effect, February effect, March effect, April effect, May effect, June effect, July effect, August effect, September effect, October effect and November effect respectively on stock returns are statistically insignificant at the 5% level in both the EGARCH-M model and the augmented model. This implies that monthly seasonal effect in stock returns is not present in Nigeria.

The variance equation in Table 4 shows that the coefficients α are positive and statistically significant in the EGARCH-M model and the augmented model. This confirms that the ARCH effects are very pronounced implying the presence of volatility clustering. Conditional volatility tends to rise (fall) when the absolute value of the standardized residuals is larger (smaller) (Leon, 2007).

Table 4 shows that the β coefficients (the determinant of the degree of persistence) are statistically significant in the EGARCH-M model and the augmented model. The β coefficients in the EGARCH-M model and the augmented model are 0.7051 and 0.6023 respectively. This appears to show that there is a high persistence in volatility in Nigeria. The augmented EGARCH-in-Mean model where the banking reform, insurance reform, the stock market crash and global financial crisis variables are added to variance equation indicates that Θ_1 (coefficient of banking reform) and Θ_3 (coefficient of stock market crash) are statistically significant while the others are insignificant. Both Θ_1 and Θ_3 carry the right sign. Θ_1 is negative while Θ_3 is positive, This appears to indicate that the banking reform and the stock market crash have an impact on volatility while insurance reform and global financial crisis have no impact on volatility.

Table 4 shows that the coefficients of γ, the asymmetry and leverage effects, are negative and statistically significant at the 5% level in the EGARCH-M model and the augmented model. The predominance negatively significance of in the results, appears to show that the asymmetry and leverage effects are accepted in the EGARCH-M model and the augmented model.

The coefficients h_1, h_2, h_3, h_4, h_5, h_6, h_9, h_{10} and h_{11} representing January effect, February effect, March effect, April effect, May effect, June effect, September effect, October effect and November effect in volatility are statistically insignificant at the 5% level in the augmented model in the volatility equation. However, h_7 and h_8 representing July effect and August effect are statistically significant in the volatility equation in the augmented model. This implies that the presence of July effect and August effect in stock return volatility in Nigeria.

The estimated coefficients of the degree of freedom, v are significant at the 5-percent level in EGARCH-M model and the augmented model implying the appropriateness of student t distribution. The Wald test for the mean equation shows that F-statistic and Chi-square are statistically insignificant in the mean equation in both the EGARCH-M model and the augmented model. However, the Wald test for the variance equation in the augmented model shows that F-statistic and Chi-square are statistically significant in the variance equation. This appears to imply the absence of monthly effect in stock returns but there exists monthly effect in stock volatility.

Table 4: OLS Regression of Stock Returns, Month-of-the-Year Seasonality in Stock Returns, Financial Reforms, Stock Market Crash and the Global Financial Crisis

	Seasonality Equation (2)		**Reforms, Stock Market Crash and Global Financial Crisis Equation (4)**		**Seasonality, Reforms, Stock Market Crash and Global Financial Crisis Equation (5)**	
	Coefficient.	Prob.	Coefficient.	Prob.	Coefficient.	Prob.
b_0	-0.0030	(0.6898)	0.0106	(0.1199)	0.0077	0.4716
d_1	-0.7743	(0.0000)*	-0.7862	(0.0000)*	-0.7932	(0.0000)*
d_2	-0.5937	(0.0000)*	-0.6142	(0.0000)*	-0.6263	(0.0000)*
d_3	-0.4534	(0.0000)*	-0.4796	(0.0000)*	-0.4954	(0.0000)*
d_4	-0.3445	(0.0000)*	-0.3736	(0.0000)*	-0.3919	(0.0000)*
d_5	-0.2620	(0.0000)*	-0.2914	(0.0000)*	-0.3113	(0.0000)*
d_6	-0.1983	(0.0000)*	-0.2252	(0.0000)*	-0.2462	(0.0000)*
d_7	-0.1446	(0.0003)*	-0.1661	(0.0000)*	-0.1875	(0.0000)*
d_8	-0.0961	(0.0080)*	-0.1143	(0.0015)*	-0.1295	(0.0004)*
d_9	-0.0522	(0.0671)	-0.0634	(0.0253)*	-0.0716	(0.0122)*

	Coefficient.	Prob.	Coefficient.	Prob.	Coefficient.	Prob.
b_1	-0.0014	(0.8934)			-0.0018	(0.8585)
b_2	0.0130	(0.2031)			0.0122	(0.2313)
b_3	-0.0029	(0.7798)			-0.0101	(0.3425)
b_4	0.0131	(0.2284)			0.0119	(0.2847)
b_5	0.0073	(0.4871)			0.0045	(0.6755)
b_6	0.0060	(0.5689)			0.0034	(0.7557)
b_7	0.0011	(0.9121)			0.0005	(0.9631)
b_8	0.0007	(0.9482)			-0.0002	(0.9883)
b_9	0.0081	(0.4455)			0.0090	(0.3918)
b_{10}	-0.0041	(0.6996)			-0.0045	(0.6672)
b_{11}	-0.0017	(0.8740)			-0.0019	(0.8585)
g_1			-0.0136	(0.0899)	-0.0127	(0.1355)
g_2			0.0098	(0.0592)	0.0105	(0.0489)*
g_3			-0.0165	(0.0301)*	-0.0199	(0.0154)*
g_4			-0.0165	(0.0884)	-0.0143	(0.1834)
$\bar{R}^2$	0.3655		0.3770		0.3760	
LL	1505.1350		1513.1260		1517.7080	
AIC	-2.3595		-2.3833		-2.3731	
SC	-2.2738		-2.3262		-2.2711	
HQC	-2.3273		-2.3619		-2.3348	
F	37.2006	(0.0000)*	59.5149	(0.0000)*	32.5613	(0.0000)*
DW	2.0036		2.0061		2.0079	
N	1267		1267		1267	
Wald test (b_1 ...b_{11}=0)						
F-statistic	0.6706	(0.7674)			0.8898	(0.5421)
Chi-square	7.3768	(0.7678)			8.8981	(0.5418)

Notes: p-values are in parentheses. * indicates significant at the 5% level. LL, AIC, SC, HQC, DW and N are the maximum log likelihood, Akaike information Criterion, Schwarz Criterion, Hannan-Quinn criterion, Durbin-Watson and Number of observations respectively

Table 5: Parameter Estimates of the EGARCH-in-Mean Models January 2, 2004 - March 2, 2009

	EGARCH-M (1,1)		AUGMENTED EGARCH-M (1,1)	
	Coefficient	Prob.	Coefficient	Prob.
Mean Equation				
b_0	0.0000	(0.9837)	-0.0007	(0.7565)
d_1	0.5461	(0.0000)*	0.4925	(0.0000)*
f	0.2274	(0.0872)	0.2219	(0.1887)
g_1	-0.0018	(0.0132)*	-0.0008	(0.4723)
g_2	0.0008	(0.0951)	0.0007	(0.1343)
g_3	-0.0025	(0.0011)*	-0.0036	(0.0040)*
g_4	0.0006	(0.5307)	0.0001	(0.9530)
b_1	-0.0013	(0.1180)	-0.0010	(0.2962)
b_2	0.0000	(0.9769)	-0.0001	(0.9486)
b_3	-0.0016	(0.0779)	-0.0010	(0.3334)
b_4	-0.0004	(0.6533)	0.0001	(0.9159)
b_5	-0.0002	(0.7897)	0.0004	(0.7158)
b_6	-0.0002	(0.7828)	-0.0008	(0.5104)
b_7	-0.0004	(0.6575)	0.0005	(0.6329)
b_8	-0.0004	(0.6157)	-0.0014	(0.3010)
b_9	-0.0012	(0.1956	-0.0006	(0.5685)
b_{10}	-0.0012	(0.1977)	-0.0002	(0.8574)
b_{11}	-0.0012	(0.1630)	-0.0012	(0.2551)
Variance Equation				
h_0	-2.9291	(0.0000)*	-3.6535	(0.0000)*
α	0.2850	(0.0000)*	0.2143	(0.0000)*
γ	-0.2306	(0.0000)*	-0.1667	(0.0000)*
β	0.7051	(0.0000)*	0.6023	(0.0000)*
Θ_1			-0.3421	(0.0070)*
Θ_2			0.0487	(0.4736)
Θ_3			0.3836	(0.0010)*
Θ_4			-0.0570	(0.6695)
h_1			-0.0684	(0.6267)
h_2			0.0814	(0.5645)

h_3			-0.2191	(0.1284)
h_4			-0.1271	(0.4120)
h_5			-0.1989	(0.1776)
h_6			0.1853	(0.2278)
h_7			-0.3169	(0.0329)*
h_8			0.3936	(0.0090)*
h_9			-0.1116	(0.4093)
h_{10}			-0.2572	(0.0644)
h_{11}			0.0616	(0.6757)
ν	3.1593	(0.0000)*	3.5482	(0.0000)*
LL	4287.6730	4326.8540		
AIC	-6.7372		-6.7754	
SC	-6.6438		-6.6211	
HQC	-6.7021		-6.7174	
N	1267		1267	
Wald Test:				
F-statistic	0.7515	(0.6759)	0.7978	(0.6309)
Chi-square	7.5153	(0.6761)	7.9784	(0.6309)
F-statistic			2.7353	(0.0025)*
Chi-square			27.3534	(0.0023)*

Notes: p-values are in parentheses. * indicates significant at the 5% level. LL, AIC, SC, HQC and N are the maximum log likelihood, Akaike information Criterion, Schwarz Criterion, Hannan-Quinn criterion and Number of observations respectively.

4.2 Diagnostic checks

Tables 6 and 7 show the results of the diagnostic checks on the estimated OLS regression, EGARCH-in-mean model and the augmented model. Table 6 shows that the Ljung-Box Q-test statistics of the residuals for the remaining serial correlation in the regression equations (2), (4) and (5) are statistically insignificant at the 5% level confirming the absence of serial correlation in the residuals. This shows that the regression equations are well specified. Table 7 shows that the Ljung-Box Q-test statistics of the standardized residuals for the remaining serial correlation in the mean equation are statistically insignificant at the 5% level for the EGARCH-M model and the augmented model confirming the absence of serial correlation in the standardized resid-

Table 6: Autocorrelation of Residuals, Autocorrelation of Squared Residuals and ARCH LM test for the OLS Regressions of Stock Returns, Seasonality, Financial Reforms, Stock Market Crash and the Global Financial Crisis over the period January 2, 2004 - March 2, 2009

	Seasonality Equation (2)	Reforms, Stock Market Crash and the Global Financial Crisis Equation (4)	Seasonality, Reforms, Stock Market Crash and Global Financial Crisis Equation (5)
Ljung-Box Q Statistics			
Q(1)	0.0046 (0.9460)	0.0118 (0.9130)	0.0204 (0.8860)
Q(6)	0.3042 (0.9990)	1.2120 (0.9760)	1.6648 (0.9480)
Q(12)	3.0674 (0.9950)	11.8450 (0.4580)	15.5340 (0.2140)
Q(20)	4.8408 (1.0000)	13.3010 (0.8640)	16.6660 (0.6750)
Ljung-Box Q^2 Statistics			
$Q^2(1)$	3.9358 (0.0470)	2.9104 (0.0880)	2.7534 (0.0970)
$Q^2(6)$	6.3638 (0.3840)	4.7274 (0.5790)	4.5618 (0.6010)
$Q^2(12)$	6.3766 (0.8960)	4.7525 (0.9660)	4.6002 (0.9700)
$Q^2(20)$	6.3905 (0.9980)	4.7665 (1.0000)	4.6132 (1.0000)
ARCH-LM TEST			
ARCH-LM (1)	3.9293 (0.0477)*	2.9032 (0.0887)	2.7463 (0.0977)
ARCH-LM (5)	1.1482 (0.3329)	0.8611 (0.5067)	0.8297 (0.5285)
ARCH-LM (10)	0.5702 (0.8393)	0.4288 (0.9331)	0.4144 (0.9403)
ARCH-LM (15)	0.3774 (0.9847)	0.2840 (0.9967)	0.2745 (0.9973)
ARCH-LM (20)	0.2810 (0.9993)	0.2116 (0.9999)	0.2044 (0.9999)

Note: p values are in parentheses.

Table 7: Autocorrelation of Standardized Residuals, Autocorrelation of Squared Standardized Residuals and ARCH LM tests for the EGARCH-in-Mean Models over the period January 2, 2004 - March 2, 2009

	EGARCH-M (1,1)	AUGMENTED EGARCH-M (1,1)
Ljung-Box Q Statistics		
Q(1)	0.0037 (0.9510)	0.0006 (0.9800)
Q(6)	0.0520 (1.0000)	0.0444 (1.0000)
Q(12)	0.3760 (1.0000)	0.3623 (1.0000)
Q(20)	0.6152 (1.0000)	0.5032 (1.0000)
Ljung-Box Q^2 Statistics		
$Q^2(1)$	0.0008 (0.9770)	0.0008 (0.9770)
$Q^2(6)$	0.0050 (1.0000)	0.0049 (1.0000)
$Q^2(12)$	0.0097 (1.0000)	0.0095 (1.0000)
$Q^2(20)$	0.0164 (1.0000)	0.0161 (1.0000)
ARCH-LM TEST		
ARCH-LM (1)	0.0008 (0.9772)	0.0008 (0.9773)
ARCH-LM (5)	0.0008 (1.0000)	0.0008 (1.0000)
ARCH-LM (10)	0.0008 (1.0000)	0.0008 (1.0000)
ARCH-LM (15)	0.0008 (1.0000)	0.0008 (1.0000)
ARCH-LM (20)	0.0008 (1.0000)	0.0008 (1.0000)
Jarque-Berra	78778459 (0.0000)*	81000487 (0.0000)*

Note: p values are in parentheses.

uals. This shows that the mean equations are well specified. The Ljung-Box Q^2-statistics of the squared residuals in Table 6 are all insignificant at the 5% level the three regression equations. The Ljung-Box Q^2-statistics of the squared standardized residuals in Table 7 are all insignificant at the 5% level for the EGARCH-M model and the augmented model. The ARCH-LM test statistics in Table 6 for the OLS regression equations further showed that the residuals did not exhibit additional ARCH effect. The ARCH-LM test statistics in Table 7 for the EGARCH-M model and the augmented model also showed that the standardized residuals did not exhibit additional ARCH effect. This shows that the variance equations are well specified in for the EGARCH-M model and the augmented model. The Jarque-Bera statistics still shows that the standardized residuals are not normally distributed. In sum, all the models are adequate for forecasting purposes.

5. CONCLUSION

This paper investigated the monthly effect in the Nigerian stock market using the EGARCH-in-mean model in the light of banking reforms, insurance reform, the stock market crash and the global financial crisis. Volatility persistence, asymmetric properties and seasonality in risk-return relation of the Nigerian stock markets are investigated. The result also shows the absence of the monthly effect in stock returns but there exists a July effect and an August effect in stock volatility. It is found that the Nigerian stock market, returns show persistence in the volatility and clustering and asymmetric properties. This kind of result was found for other emerging market (Karmakar, 2005; Karmaka, 2006; Kaur, 2002; Kaur, 2004; Pandey, 2005; Leon, 2007; Kumar and Singh, 2008). The results show that volatility is persistent and there is leverage effect supporting the work of Nelson (1991). The study found little evidence in the relationship between stock returns and risk as measured by its own volatility. The study found a positive but insignificant relationship between stock return and risk. The result shows that the stock market crash since April 2008 negatively impacts on stock return while banking reform, insurance reform and the global financial crisis have little or no impact on stock return. The banking reform and the stock market crash have an impact on volatility.

It appears the stock market of emerging markets is integrated with the global financial market. It is suspected that the sub mortgage crisis in the United States which caused a liquidity crisis could have put up pressure on foreign investors in the Nigerian and other emerging stock market to sell off their shares so as to provide the needed cash to address their financial problems. The continuous sale of shares by foreign investors caused the stock prices to fall in the Nigerian stock market. The fall in stock prices resulted in the loss of investor's confidence leading to further decline as many banks that granted credit facilities for stock trading recall their loans. Further research needs to be done as to the causes of the stock market crash in the Nigerian stock market. There is a need for regulators in the emerging markets to evolve policy towards the stability and restoration of investor's confidence in the Nigerian stock market. Governments should possibly aid the promotion of market makers towards warehousing shares and creating the market for securities trading.

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Résumé

Cet article explore les fluctuations mensuelles à l'intérieur du marché boursier Nigérien, et ce à l'aide d'un modèle EGARCH-M qui tient également compte des réformes du secteur banquier, de la réforme des assurances, du krach boursier et de la crise financière globale, en se basant sur les recette journalière de la période allant du 4 janvier 2004 au 2 mars 2009. On en déduit l'absence d'un effet mensuel sur les recettes financières; toutefois, l'on remarque une majeure volatilité du marché boursier pendant les mois de juillet et d'aout. De plus, on observe que l'instabilité, ainsi que le regroupement et l'asymétrie des recettes du marché boursier Nigérien, est récurrente. Les résultats démontrent l'existence d'une volatilité récurrente et d'un effet de levier, comme souligné par Nelson (1991). Cette étude a trouvé qu'il n'existe que de faibles preuves d'une corrélation entre les recettes financières et les facteurs de risque, mesuré sur base de la volatilité même.

Mots clés: effet month of the year, marché actionnaire, réforme financière, crise globale financière, persistance de la volatilité, EGARCH-in-mean (exponential generalized autoregressive conditionally interoskedotic), rapport bénéfice-risque.