

FINANCIAL CRISIS AND CONTAGION EFFECTS ON THE NIGERIAN STOCK  
MARKET

OGBEBOR, Peter Ifeanyi (Ph.D)<sup>1\*</sup>  
OGUNTODU, James Akinola (Ph.D)<sup>2</sup>  
[jamesjogas@yahoo.com](mailto:jamesjogas@yahoo.com) (08032589294)  
SIYANBOLA, Trimisiu Tunji (Ph.D)<sup>3</sup>

<sup>1 & 2</sup>Department of Banking and Finance  
<sup>2</sup>Department of Accounting  
School of Management Sciences  
Babcock University, Ilishan-Remo, Ogun State.

\*Corresponding Author:  
[ogbebor.peter@yahoo.com](mailto:ogbebor.peter@yahoo.com)  
08020950425 and 08037737142

ABSTRACT

*Financial crisis and contagion have been established in the literature on finance and business to be easily transmitted from one market to the other when there is strong cross-market linkages due to globalization. Following several major financial crises, not the least, the 2008 – 2009 which emanated from the U.S. subprime housing crisis, this study sought to provide evidence on the level of correlation between the U.S., United Kingdom and Japanese markets on one hand and the Nigerian stock market on the other whether their linkages are cases of mere interdependence or pure contagion.*

*In order to establish this, this study employed the restrictive Constant Correlation (CCC-GARCH) and the Dynamic Conditional Correlation (DCC-GARCH), the simple linear regression technique, among others, to test whether the relationships between these markets differ remarkably in the post-crisis period from the pre-crisis period.*

*The results indicate that the CCC-GARCH and DCC-GARCH terms for some of the stock returns are statistically significant within the 1% and 10% conventional significance levels. Overall, this indicates that during the 2008 - 2009 period, the crisis influenced the conditional correlation co-efficients between the three major markets and Nigeria; but while the relationship between the U.S. and Nigerian markets was a case of pure contagion, in addition to persistence of volatility in the latter, this was not the case with the other pairs in the analysis. This result was equally substantiated by the correlation test result which indicated a pure contagion between the U.S. and Nigerian stock markets as evident from the absolute  $t = -4.750$  or  $-3.923$  ( $|t| > 2.576$  Two tail test) for adjusted and unadjusted correlations respectively.*

*Based on the findings, this study concluded that there was a case of pure contagion between the U.S. and the Nigerian stock market but not with the other pairs in the analysis whose linkages were found to be mere interdependence. By implication this validates the veracity of findings in some earlier studies that financial crisis can be transmitted, however, not all such cases were pure contagion as some were mere interdependence.*

## **1.0 INTRODUCTION**

Following globalization and financial markets integration, the interdependence among financial markets continue to increase such that whatever affects a single market easily spreads to the other markets. Financial crisis affecting one or more markets easily spreads to other markets especially when they are interconnected. In the case of financial markets, these transmission of crisis in the form of risks is unidirectional as crisis always spreads from the major markets to the less developed markets. This risk transmission process is known as contagion which can be bidirectional. Three events involving transmission of risks stand out: the great depression of 1929, the October 19, 1987 stock markets crash (generally referred to as the Black Monday) and the global financial crisis of 2008-2009. With respect to the latter, Ghini and Saidi (2013) state that it is generally recognized as one of the most severe since the Great Depression of 1929 and will be well known in the books of history and finance. In fact, Quaye, Mu, Abudu, and Agyare, (2016) described such events as Black Swans due to their nature and magnitude on a world-wide scale.

The International Bank for Reconstruction and Development otherwise known as the World Bank (2009) on its part described the crisis as crisis upon crisis, pointing out that this crisis in addition to the food and fuel crisis is pushing many poor countries into a danger zone, imposing rising human costs and imperiling development prospects. The World Bank projected that private capital flows to the developing world would slump by more than \$700 billion in 2009, first full year of the crisis; warning that the projected downside risks were low vis-à-vis the full effects of the crisis in the long run.

One of the major benefits of globalization and financial markets integration is opportunity for international diversification of risks by investors, hence, market integration between local markets and the well developed markets is seen as a necessity for the less developed markets to attract the much needed global capital in order to facilitate their development. Transmission of risks from one market to the other is almost instantaneous as a result of globalization which has been greatly facilitated due to advances in technology thereby reducing the world to a global village. Transmission of risks from one or more markets to the others have, therefore, become a big challenge to investors which invariably have affected market returns and led to high levels of volatility in markets across the globe whether developed, developing and less developed. When this happens, equity culture in less developed markets are destroyed and there will be flight to safety by investors which ultimately undermine the role of finance in economic development.

## **1.2 PROBLEM STATEMENT**

Following the devastating effects of the last global financial crisis, we investigated the aftermaths of the propagation of shocks from the United States of America (U.S.) subprime crisis to the Nigerian stock market as the Nigerian stock market has integrated with the global stock markets through financial liberalization and trade openness. The main question we seek to answer is: how significant were the shocks transmitted to the Nigerian equity market following the U.S. subprime crisis? Contextually, the question is: following S & P 500 stock returns crash, did the crash and its effects on the FTSE stock market (United Kingdom) and NIKKEI 225 stock market (Japan) lead to a significant decrease in the All Share Index (stock market returns in Nigeria) in value around the break-point date of S & P 500 returns given the interdependence between the major markets and a frontier market like Nigeria?

## **1.3 OBJECTIVE**

This study sought to establish the nature of the relationship between the major global stock markets and the Nigerian stock market. In particular, we sought to establish the extent to which global shocks in the form of contagion can be transmitted from the major markets to the Nigerian equity market being a small open market but well integrated with the world markets due to globalization. This study sought to identify the full effects of the crisis over the long run as effects of such crisis with the extent of its scale and magnitude

will take years to manifest. In this direction, a snap-short analysis will lead to series of short-comings since the effects are sequencing, hence, a long-run analysis covering the period: 2008 – 2017 is desired to achieve the major objective of this study. Following the gale of financial crises and attendant fallouts, Bergmann, Securato, Savoia and Contani (2015) raised important questions with respect to the recent financial crises that occurred in the Latin American economies concerning the benefits of diversification, the robustness of domestic financial institutions and the extent of the domino effect with asymmetries in propagation of contaminations. In their study, they sought to unravel whether financial markets become more interdependent during financial crises. While these questions are important for the Latin American Countries, so it is for other emerging and less developed markets such as Nigeria, hence, this study.

#### **1.4 JUSTIFICATION**

The selection of the three major foreign markets is due to their leadership positions in global stock market ranking and as stated by Masih and Masih (2001), the three markets accounted for 75% of global stock market capitalization and there is no empirical evidence that this situation has changed. Besides, Ghini and Saidi (2013) informed that the Nigerian Stock Market is Africa's second largest stock market after Johannesburg Stock Market in South Africa; which establishes the fact that the Nigerian stock market is an important one in Africa and part of the emerging markets getting significant attention globally. Based on this, we therefore, investigated empirically the co-movements between the U.S., U.K., Japanese and the Nigerian stock markets.

Contagion, according to Forbes and Rigobon (1999) can be defined as a significant increase in the cross-market correlation during the period of turmoil. This is a case of shift contagion which Ghini and Saidi (2013) define as a significant increase in correlations between stock returns during crisis periods. Therefore, significant co-movements between markets after a shock to one without prior traditional co-movements between them can be described as contagion. Forbes and Rigobon (1999) cited examples of the 1997 East Asian crisis, the 1994 Mexican peso collapse and the 1987 U.S. stock market crash as dramatic movements in one stock market with ripple effects on other markets of very different sizes and structures throughout the world. But clearly, this is against the avowed benefits of market integration which had been orchestrated will lead to international diversification of risks and attendant benefits. For instance, Ogbebor (2018) argued that the whole essence of liberalization is to spur growth in the liberalizing country through increased inflows of funds in order to expand the investment horizon which ultimately will lead to higher economic growth and development. The author further added that one of the benefits of market opening is the integration of the local market with the global market which will allow for risk sharing between domestic and foreign agents. For stock markets, Forbes and Rigobon (1999) argued that international diversification would substantially reduce portfolio risks and increase expected returns. Why is it not so in the case of Nigeria?

Ujunwa, Salami and Umar, (2011) stated that the scale and magnitude of the 2007 – 2009 global subprime crisis in the U.S. has shaken the very foundations of international financial markets. In the case of Nigeria, Nwude (2012) claimed that the All Share Index and market capitalization fell from historic highs of 64,128.69 and N12.30 trillion on Friday February 22, 2008 to 28,085.01 and N6.21 trillion on Tuesday, December 16, 2008 respectively. Various studies have been carried out on the effects of the U.S. subprime financial crisis (Olowe, 2009, Adamu, 2010, Chong, 2011, Ujunwa, *et al*, 2011, Ghini & Saidi, 2013, Gharsellaoui, 2013, Singhania & Achalia, 2013 and Bergmann, *et al*, 2015). But studies which have examined the interdependence or contagion between the U.S., United Kingdom, Japanese stock markets and the Nigerian stock market following the global financial crisis of 2008 - 2009 have not yet populated the literature. Specifically, the World Bank (2009) predicted recession as part of the second round of the crisis for most developing countries which has come to pass in the case of Nigeria as the country experienced recession in less than a decade after the crisis. As a result, the important components of linkages among the markets involved in this study over the long run will be dissected since the long run linkages among markets in this type of studies are important. In this regard, this study, therefore, contributes to the

literature on financial crisis and contagion among the financial markets around the financial crisis of 2007 – 2009 including the immediate pre-and-post crisis period.

The rest of the paper is organized as follows: Section II Reviews the Relevant literature; Section III covers The Study Design; Section IV deals with Data Analysis; Section V covers Findings while Section VI contains Conclusion and Recommendations.

## **2.0 REVIEW OF LITERATURE**

The aftermath of a shock in one market that causes a significant change in the other is known as contagion. In trying to understand whether a contagion has occurred, there are approaches towards the measurement of contagion otherwise mere cases of interdependence can be mistaken for contagion. Forbes and Rigobon (1999) defined contagion as a significant increase in the cross market correlation during the period of turmoil. To them, the nature of the co-movements in the markets involved prior to the significant increase in the co-movement determines whether such can be regarded as contagion or interdependence. Based on these, the authors explained that contagion implies that cross-market linkages are fundamentally different after a shock to one market, while interdependence implies no significant change in cross-market relationship. Dajcman (2013) argues that contagion has to be separated from interdependence, pointing out that a failure to model common factors may result in tests of contagion being biased towards a positive finding of contagion. What this implies is that mis-specification or use of wrong models can lead to spurious results, hence, mere cases of interdependence can be mis-interpreted as contagion.

One of the arguments of Forbes and Rigobon (1999) is that international diversification would substantially reduce portfolio risk and increase expected returns. This point can be buttressed on the basis of argument by Longin and Solnik (1995) who relying on evidence in finance literature, maintained that international diversification of equity portfolios has been advocated on the basis of the low correlation between national stock markets. Similarly, Dajcman (2013) maintained that in the mainstream financial literature, it has been recognized that international diversification reduces the total risk of a portfolio, explaining further that this is due to non-perfect positive co-movement between returns of the portfolio assets.

Ghini and Saidi (2013) posited that stock markets crash around the world during the crisis as demonstrated by financial contagion of recent global financial crisis. They argued further that the financial crisis that first hit the U.S. and other developed markets, equally spread to other markets around the world soon afterwards. In a dramatic fashion, the crisis was not limited to stock markets. Li and Li (2012) studied the impact of the U.S. subprime crisis on the housing market in Canada. The comovements between the U.S. subprime crisis and the Canadian housing market can be linked to the nature of the relationship between the U.S. and Canadian economies, even as Li and Li (2012) referred to both countries as regional and trading partners as well as being traditional allies. But common factors such as international interest rates, international trade and stock markets were common factors proxied in the relationship between markets, thus, Dajcman (2013) argues that these variables should be common factors to be included in models of such co-movements.

Bergmann, *et al* (2015) argued that a central issue in asset allocation and risk management is whether financial markets become more interdependent during financial crisis while Ncube and Mingiri (2015) are of the opinion that financial theory suggested that integrated stock markets are more efficient as compared to segmented stock markets. The knowledge about the channels of transmission and the impact of shocks in other markets are challenges which remain daunting to policy makers, regulators and other stakeholders especially in emerging and less-developed markets. Dajcman (2013) identified three common factors through which contagion can be transmitted to include international interest rates, international trade and stock market indices. For instance, Ujunwa, *et al.* (2011) pointed out that policy makers and regulators in Nigeria failed to anticipate the consequences of the global financial crisis on the Nigerian economy which was eventually ravaged by the crisis to the extent that the equity culture cultivated following stock market

liberalization and subsequent growth of the market has suffered a sharp decline as a result of investors' anemia towards investing.

The foregoing points to the grave implication of learning from hindsight which complicates an already bad situation. As Ncube and Mingiri (2015), monetary policies in a domestic economy could be affected by the linkages between the local capital and other markets both regionally and globally. This is a major pitfall of liberalization and globalization. Gharsellaoui (2013) explicated further by attributing the phenomenon of financial contagion to financial globalization or integration of international financial markets. Also, greater risk taking which has increased significantly has been attributed by Singhania and Achalia (2013) to the globalization of finance and subsequent easy credit conditions that ultimately encouraged high-risk lending and borrowing practices. This without doubt, leads to creation of toxic assets.

Empirically, results from studies of contagion in the literature have been mixed. In the case of Pakistan and India, Ali and Afzal (2012) established that the shocks from the global financial crisis had mild negative impact on stock returns in Pakistan and India but with a stronger impact on the latter. Nicklas and Thong (2012) found that on the average, global and regional correlations have risen steadily over the past twenty years and also established that international equity returns have become increasingly exposed to risk exposures that are stochastic in nature. Singhania and Achalia (2013) found a positive effects of the global financial crises on the volatility of returns of Japan, China and India while no such impacts were found on the returns of Hong Kong. The crisis (the global financial crisis) was stated by Ghini and Saidi (2013) to reveal a high interdependence between financial markets worldwide. Specifically, the authors established a correlation between the Moroccan stock market with those of U.S., U.K. and France. Furthermore, the authors found that bad news about economic partners of Morocco did, indeed, generate contagion in the local stock market. In the case of the Canadian housing market, Li and Li (2012) found a decrease in income per capita that hurt the housing market.

Dajcman (2013) established that the global financial crisis coincides with contagion from both Italian and the Spanish stock markets to German stock market, while Ireland's debt crisis coincides with contagion from Ireland's to German stock market. A primary finding of their study confirms the findings of other studies that shift-contagion has played a role in the propagation of financial shocks during the major financial crises in the time period covered by the studies. Gharsellaoui (2013)'s findings regarding the impact of the U.S. subprime crisis on the Tunisian Market show that the market was somehow immuned from the crisis due to the under-developed nature of the market. On their part, Kilic, Chelikani and Coe (2014) found that the Turkish financial industries mainly dominated by foreign firms (banking and insurance companies) unlike mutual funds, real estate and leasing companies were significantly affected by shift contagion. Adopting Copula theory, Bergmann, *et al*, (2015) found that the negative effects of the U.S. subprime crisis in the U.S. market had a negative effect more on the European Union market than on the BRIC (Brazil, Russia, India and China)'s markets. In the case of stock market integration between the Johannesburg stock market and a select group of other stock markets in the African continent, Ncube and Mingiri (2015) shows that developments in the international markets affect African stock markets. This result, according to the authors, suggest that portfolio diversification opportunities exist in these markets, hence, they solicit for investors' participation in these markets due to inherent opportunities therein. In the case of Nigeria, Njiforti (2015) found that the global financial crisis adversely and significantly affected the Nigerian capital market both in the short and long run periods. In the same vein, Onuoha and Nwaiwu (2016) established that the global financial crisis had a negative and significant impact on the Nigerian stock market. On their part, Alimi and Adediran (2018) found that the global financial crisis led to increase in volatility in the Nigerian capital market, hence, uncertainties were created for investors and speculators.

### **3.1 THE STUDY DESIGN**

A major part of the estimation techniques in this study is to test the correlation co-efficient between the United States, United Kingdom, Japanese stock markets and the Nigerian stock market both in calm and turbulent periods. Both the restrictive Constant Correlation (CCC-GARCH) will be employed to test

whether the assumptions of constant correlations will be rejected by the data and the time varying Dynamic Conditional Correlation (DCC) multivariate GARCH model of Engel (2002) will be employed to test whether the mean of the DCC-GARCH estimated conditional correlation co-efficient in post-crisis period differ from those in the pre-crisis period. The structural break tests of Bai-Pierre (1998, 2003) and Lee-Strazicich (2003, 2004) will be used in similar manner like Ghini and Saidi (2013), hence, the overall sample data were sub-divided into pre-and post-crisis periods in order to determine the break point of S & P 500. The usual estimation of stock returns was carried out in addition to the use of simple linear regression model. Tests are also to be based on both the unadjusted correlation coefficients and adjusted correlation coefficients in order to find out whether the co-movements between the markets studied were cases of interdependence or they meet the criteria to be regarded as shift contagion. The Data used being time series, the usual Stationarity Tests will be carried out.

i) ESTIMATION OF STOCK RETURNS

Stock returns will be estimated with the following formula:

$$R_{i,t} = \ln \left( \frac{P_{i,t}}{P_{i,t-1}} \right) * 100$$

Where:

$R_{i,t}$ : = Stock returns of market  $i$  in the period  $t$

$P_{i,t}$  = Stock price index

ii) CONTAGION TESTS

Contagion tests using Adjusted and Unadjusted Correlation Tests will be estimated using the following simple linear regression model:

Correlation Test formula following a simple linear regression model is stated as:

$$y_{i,t} = \alpha + \beta x_{i,t} + \varepsilon_{i,t}$$

Where:  $\alpha$ ,  $\beta$  and  $\varepsilon$  are intercept, regression coefficient and error term respectively. The unadjusted correlation coefficient between  $y_{i,t}$  and  $x_{i,t}$  will be computed with the following formula:

$$\rho = \frac{\sum xy - (\sum x^2 \sum y^2)}{\sqrt{v(x_{i,t}) * v(y_{i,t})}}$$

According to Forbes and Rigobon (2002), the adjusted correlation coefficient will be computed with the following formula

$$\rho^* = \frac{\rho}{\sqrt{1 + \delta[1 - (\rho)^2]}}$$

where  $\delta = \frac{v^r(x_{i,t})}{v^o(x_{i,t})} - 1$

$H_0$ : There is no evidence of contagion between the USA, UK and Japanese stock markets and the Nigerian stock market.

$H_1$ : There is evidence of contagion between the USA, UK and Japanese stock markets and the Nigerian stock market.

The Nigerian Stock Exchange (NSE) is Africa's second largest stock exchange after Johannesburg Stock Exchange according to Ghini and Saidi (2013). Miles (2002) and Bekaert, Harvey and Lundblad (2003)

considered the Nigerian equity market to be liberalized in 1998. The open market days are Mondays to Fridays (excluding national public holidays) and the financial trading hours are from 9.30a.m. to 2.30p.m. (GMT). Stock indices considered in this study are:

S & P 500 (United States of America)

FTSE 100 (United Kingdom)

NIKKEI 225 (Japan)

ASI (Nigeria).

Daily closing prices of the four Indices used are from January 1, 2004 to December 31, 2017.

### 3.2 DATA COLLECTION AND STUDY PERIOD

Secondary data were used. The data used were sourced from various issues of the Statistical Bulletin of the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), 2017, Nigerian Stock Exchange (NSE) Fact Books (various issues), Yahoo Finance and Federal Reserve (United States of America) Database. The study covered the period: 2004 – 2017.

### 4.0 DATA ANALYSIS

#### Descriptive Analysis

The descriptive statistics of the stock market returns considered in this study period (01/01/2004 to 31/12/2017) are presented in Table 1.

It is evident that on average; the stock market returns of United State (rS & P 500) is the highest (0.227%) during the period of this study. Conversely, United Kingdom (rFTSE100) has the lowest average return (0.140%). However, the Nigeria stock market return has the greatest risk during the period. This can be seen from the standard deviation value of 3.28. Also, the significant values of Jarque-Bera tests at 1% alpha level suggest that none of the returns is normally distributed. The Q-statistics value for all the series except rNIKKEI225 are statistically significant within the 1% and 10% conventional alpha levels and these reveal the presence of heteroscedasticity

Table 1: Descriptive Statistics

	<b>rASI</b>	<b>rFTSE100</b>	<b>rS &amp; P 500</b>	<b>rNIKKEI225</b>
<b>Obs.</b>	168	168	168	168
<b>Mean</b>	0.166	0.140	0.227	0.197
<b>Max.</b>	14.05	3.524	4.443	5.25
<b>Min.</b>	-15.89	-6.06	-8.062	-11.82
<b>Std.</b>	3.277	1.583	1.698	2.412
<b>Skewness</b>	-0.41	-0.725	-1.073	-1.004
<b>Kurtosis</b>	7.687	4.303	6.397	5.951
<b>J-Bera</b>	158.523***	26.610***	112.996***	89.176***
<b>Q-stat</b>	34.294**	30.558*	45.532***	17.18

**NOTE:** rASI = stock returns in ASI (Nigeria), rFTSE100 = stock returns in FTSE100 (United Kingdom), rS & P 500 = stock returns of S & P 500 (United States) and rNIKKEI225 = stock returns in rNIKKEI225 (Japan). \*, \*\* and \*\*\* represents 10%, 5% and 1% levels of significance respectively.

Stationarity Test

Table 2 presents a summary of unit root results regarding the order of integration based on Augmented Dickey-Fuller test (ADF) and Phillips-Perron (PP) unit root test criteria. The null hypothesis for the ADF and PP tests is ‘no stationarity’ implying presence of a unit root. According to the result, the p-value ( $p < 0.01$ ) of the series suggests the rejection of the null hypothesis of no stationarity in each series at levels at 1% alpha level. This is to say that all the series are integrated of order zero. That is, all the returns are  $I(0)$ .

Table 2: Unit Root

Returns	@ Level		@ 1 <sup>st</sup> Difference		Order
	ADF	PP	ADF	PP	
	t-stat.		t-stat.		
rASI	-11.408***	-11.393***	- 10.426***	-66.217***	I(0)
rFTSE100	-12.881***	-12.929***	- 14.928***	-32.623***	I(0)
rS & P 500	-10.977***	-11.042***	- 13.931***	-19.695***	I(0)
rNIKKEI225	-10.900***	-10.943***	- 12.463***	-38.692***	I(0)

*NOTE: rASI = stock returns in ASI (Nigeria), rFTSE100 = stock returns in FTSE100 (United Kingdom), rS & P 500 = stock returns of S & P 500 (United States) and rNIKKEI225 = stock returns in rNIKKEI225 (Japan). \*, \*\* and \*\*\* represents 10%, 5% and 1% levels of significance respectively.*

### Dynamic Conditional Correlation using univariate GARCH (1, 1)

In Figure 1, the graphs of Dynamic Conditional Correlation using univariate GARCH (1, 1) for pre- and post-crisis periods for each rASI - rFTSE100, rASI - rS & P 500 and rASI - rNIKKEI225 are presented. The results of the Univariate CCC and DCC-GARCH which report the estimations of the stock returns are summarized in Tables 4, 5 and 6 for pre – crises (01/01/2004 to 28/02/2007), post-crisis (01/03/2007 to 31/12/2017) and overall (01/01/2004 to 31/12/2017) periods respectively. The structural break tests of Bai-Pierre (1998, 2003) and Lee-Strazicich (2003, 2004) were used in similar manner like Ghini and Saidi (2013) to determine the post-crisis and pre-crisis periods (break point of S & P 500). The results indicate that the ARCH term and GARCH terms for some stock returns are statistically significant within the 1% and 10% conventional significance levels. At the same time, the sum of the estimated parameters is close to unity for some stock returns and this indicates persistence of volatility during such time periods. Also, the estimated Constant Conditional Correlation (CCC) and Dynamic Conditional Correlation (DCC) with 2-step procedure parameters (using Eviews Script and Eren Ocakverdi (2014) DCC-GARCH11 add-in package) for some stock returns are statistically significant within the 1% and 10% conventional significance levels. These confirm the applicability of the time – varying correlation coefficient (DCC-GARCH) approach in examining the volatility spillover during the period. Furthermore, all the models’ diagnostics reveal that residual of the models are free from serial correlation and heteroscedasticity as evident from the insignificant values of Q-stat. and GARCH tests. On the contrary, the tests show that most of the residuals are not normally distributed but this can be ignored as the non-normality problems may not be very serious.

The dynamic conditional correlation coefficient graph in Figure 1 clearly shows that the correlation coefficients actually vary in time. In the graphs, negative and positive variations are noticeable. It can be seen that the conditional correlation between rASI and each of the other stock returns are generally higher during the post – crises period especially during 2008 and 2009 period. However, the rASI-rS & P 500 correlation appears to be the highest (28.9%; November, 2008) when compared with the other pairs. These

indicate that during the 2008 and 2009 period, the crisis influenced the conditional correlations between Nigeria and the other countries. Furthermore, Tables 3, 4 and 5 which contain details of the univariate-CCC-GARCH and DCC-GARCH tests for the pre-crisis period, post-crisis period and the full sample respectively further explicates the outcome of the estimation results of statistical significance of the contagion effects from the U.S. market and volatility in the Nigerian market following the last global financial crisis.

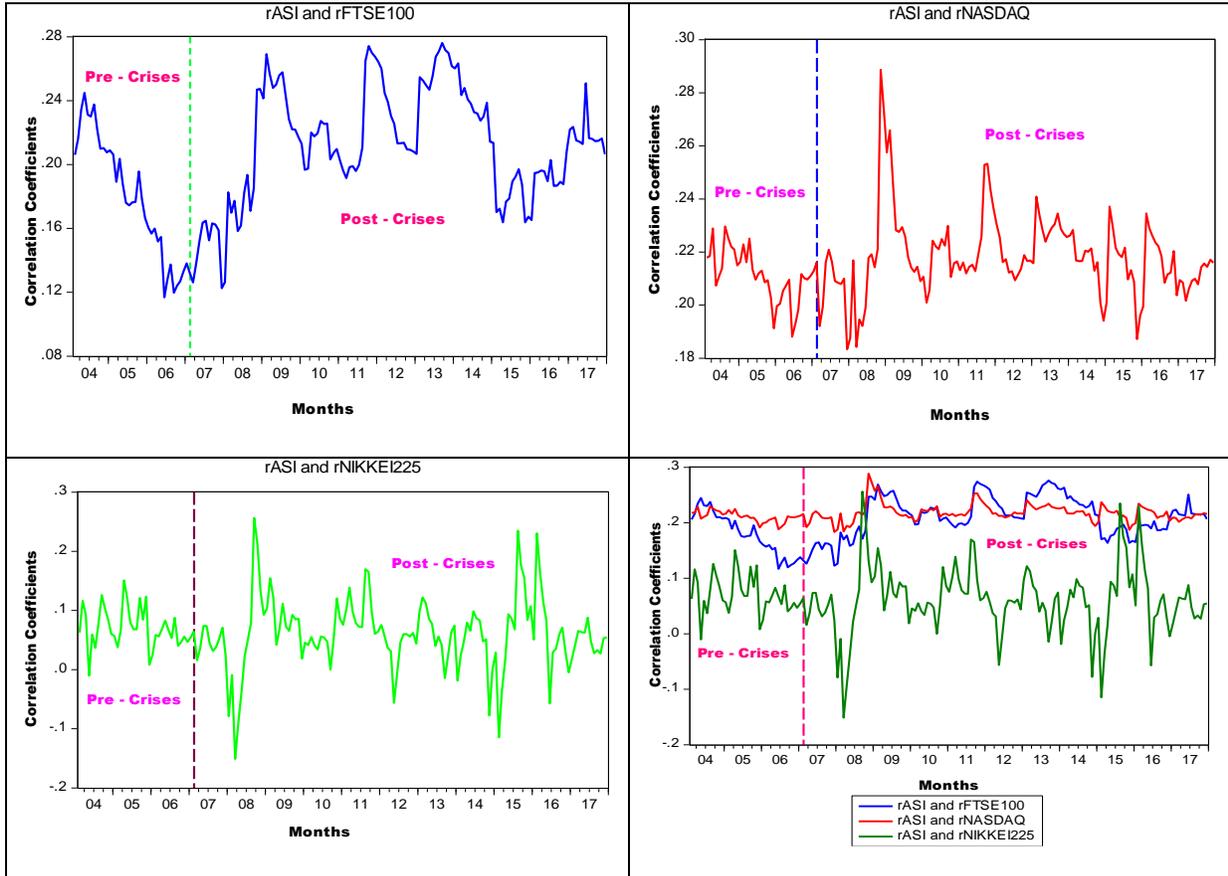


Figure 1: Dynamic Conditional Correlation

**Table 3: Pre-Crisis Period: Univariate CCC-GARCH and DCC-GARCH model**

	rASI and rFTSE100		rASI and rNASDAQ		rASI and rNIKKEI225	
	rASI	rFTSE100	rASI	rNASDAQ	rASI	rNIKKEI225
<b>Mean Model</b>						
<i>c</i>	0.522**	0.502**	0.522**	0.270***	0.522**	0.193**
<b>Variance Model</b>						
$\omega$	0.499*	0.113***	0.499*	0.722***	0.499*	0.351***
$\alpha$	-0.354**	-0.248***	-0.354**	-0.321***	-0.354**	-0.208
$\beta$	1.303***	1.080***	1.303***	0.344	1.303***	1.090***
<i>Log Likelihood</i>	-84.454	-46.283	-84.454	-46.342	-84.454	-69.014
<b>CCC Model</b>						
<i>a</i>	-0.060		0.040		-0.154*	
<i>b</i>	0.656		0.816***		0.733***	
<i>Log Likelihood</i>	-128.084		-129.434		-151.735	
<b>DCC Model</b>						
<i>R1,2</i>	-0.240		-0.064		0.091	
<i>Log Likelihood</i>	-131.552		-133.784		-159.979	
<b>Diagnostic</b>						
<i>Q – Stat. (16)</i>	21.767	18.339	21.767	13.765	21.767	13.102
<i>ARCH</i>	0.071	0.453	0.071	1.364	0.071	0.921
<i>Normality</i>	0.350	0.198	0.350	1.868	0.350	0.387***

**Source:** Authors' Computation 2018; **NOTE:** *rASI* = stock returns in ASI (Nigeria), *rFTSE100* = stock returns in FTSE100 (United Kingdom), *rNASDAQ* = stock returns in NASDAQ (United States) and *rNIKKEI225* = stock returns in rNIKKEI225 (Japan). \*, \*\* and \*\*\* represents 10%, 5% and 1% levels of significance respectively.

**Table 4: Post-Crisis Period: Univariate CCC-GARCH and DCC-GARCH model**

	rASI and rFTSE100		rASI and rNASDAQ		rASI and rNIKKEI225	
	rASI	rFTSE100	rASI	rASI	rFTSE100	rASI
<b>Mean Model</b>						
<i>c</i>	0.475**	0.145	0.474**	0.415***	0.474**	0.264
<b>Variance Model</b>						
$\omega$	1.186	0.246	1.186	0.123	1.186	1.003
$\alpha$	0.196	0.127	0.196	0.305**	0.196	0.172
$\beta$	0.710***	0.791***	0.710***	0.698***	0.710***	0.686***
<i>Log Likelihood</i>	-332.587	-248.097	-332.587	-247.863	-332.587	-302.335
<b>CCC Model</b>						
<i>a</i>	-0.037**		0.020		0.078	
<i>b</i>	0.987***		0.576		0.493	
<i>Log Likelihood</i>	-574.030		-574.437		-633.649	
<b>DCC Model</b>						
<i>R1,2</i>	0.283***		0.289***		0.055	
<i>Log Likelihood</i>	-575.366		-574.850		-634.732	
<b>Diagnostic</b>						
<i>Q – Stat. (18)</i>	12.156	13.461	12.156	23.903	12.156	11.899
<i>ARCH</i>	1.289	0.001	1.289	0.031	1.289	1.878

<i>Normality</i>	12.597***	7.278	12.597***	10.648	12.597***	10.034***
------------------	-----------	-------	-----------	--------	-----------	-----------

**Source:** Authors' Computation 2018; **NOTE:** *r*ASI = stock returns in ASI (Nigeria), *r*FTSE100 = stock returns in FTSE100 (United Kingdom), *r*NASDAQ = stock returns in NASDAQ (United States) and *r*NIKKEI225 = stock returns in rNIKKEI225 (Japan). \*, \*\* and \*\*\* represents 10%, 5% and 1% levels of significance respectively.

**Table 5: Full Sample: Univariate CCC-GARCH and DCC-GARCH model**

<b>Full Sample</b>						
	<b>rASI and rFTSE100</b>		<b>rASI and rNASDAQ</b>		<b>rASI and rNIKKEI225</b>	
	rASI	rFTSE100	rASI	rNASDAQ	rASI	rNIKKEI225
<b>Mean Model</b>						
<i>c</i>	0.471***	0.218**	0.471***	0.336***	0.471***	0.334**
<b>Variance Model</b>						
<i>ω</i>	1.238	0.086	1.238	0.114*	1.238	0.622
<i>α</i>	0.177*	0.114	0.177*	0.242**	0.177*	0.166
<i>β</i>	0.705***	0.856***	0.705***	0.734***	0.705***	0.735***
<i>Log Likelihood</i>	-421.925	-298.830	-421.925	-297.654	-421.925	-376.9921
<b>CCC Model</b>						
<i>a</i>	0.015		0.010		0.052	
<i>b</i>	0.923***		0.703		0.498	
<i>Log Likelihood</i>	-716.301		-714.913		-797.078	
<b>DCC Model</b>						
<i>R</i> <sub>1,2</sub>	0.199**		0.228***		0.070	
<i>Log Likelihood</i>	-722.105		-718.976		-797.078	
<b>Diagnostic</b>						
<i>Q – Stat.</i> (20)	12.658	15.073	12.658	24.277	12.658	13.530
<i>ARCH</i>	0.696	0.170	0.696	0.042	0.696	1.222
<i>Normality</i>	15.746***	13.553***	15.746**	12.618	15.746**	11.104***

**Source:** Authors' Computation 2018; **NOTE:** *r*ASI = stock returns in ASI (Nigeria), *r*FTSE100 = stock returns in FTSE100 (United Kingdom), *r*NASDAQ = stock returns in NASDAQ (United States) and *r*NIKKEI225 = stock returns in rNIKKEI225 (Japan). \*, \*\* and \*\*\* represents 10%, 5% and 1% levels of significance respectively.

### Contagion Test using Adjusted and Unadjusted Correlation Test

In order to find out whether the co-movements between the markets studied were cases of interdependence or shift contagion we employed Forbes and Rigobon (2002) contagion test approach using Adjusted and Unadjusted Correlation Test. According to them, shift contagion is a significant increase in correlations between stock return during financial crises period.

The result of this test as contained in Table 6 indicates that the Nigeria stock return was significantly affected by the United State (S & P 500) stock market suggesting a pure contagion at 1% level; as evident from the absolute  $t = 4.750$  or  $3.923$  ( $p < 0.01$ ) for adjusted and unadjusted correlations respectively.

Table 6: Contagion test using Adjusted and Unadjusted Correlation Test

Country: RASI and	Pre – Crises		Post - Crises		t – Statistic		Remark
	Adj. Correl.	Unadj. Correl.	Adj. Correl.	Unadj. Correl.	Adj. Correl.	Unadj. Correl.	
<b>rFTSE100</b>	0.204	0.174	0.316	0.273	-1.462	-1.277	NC
<b>rS &amp; P 500</b>	0.015	0.012	0.360	0.303	-4.750***	-3.923***	C
<b>rNIKKEI225</b>	0.127	0.115	0.093	0.084	0.449	0.408	NC

*NOTE: rASI = stock returns in ASI (Nigeria), rFTSE100 = stock returns in FTSE100 (United Kingdom), rS & P 500 = stock returns S & P 500 (United States) and rNIKKEI225 = stock returns in rNIKKEI225 (Japan). \*, \*\* and \*\*\* represents 10%, 5% and 1% levels of significance respectively.*

## 5.0 FINDINGS

The study investigated the nature of the relationship between the global stock markets in the United States of America, United Kingdom and Japan and the Nigerian stock market during the pre-and-post U.S. subprime crisis periods using time series data for the period: 2004 – 2017. The study employed both the univariate constant conditional correlation (CCC) GARCH and the Dynamic Conditional Correlation (DCC) GARCH methods which involved use of the structural break tests of Bai-Pierre (1998, 2003) and Lee-Strazicich (2003, 2004) also used recently in similar studies to test the statistical significance of the estimated stock market returns. Furthermore, simple linear regression was employed to test for contagion using Adjusted and Unadjusted Correlation Tests. The results indicated that the ARCH and GARCH terms for some of the stock returns are statistically significant within the 1% and 10% conventional significance levels. In addition, the estimated sum of the parameters is close to unity for some stock returns in the period of study which indicates persistence of volatility during such time periods. In particular, it was established that the conditional correlations between stock returns of the three major markets and ASI were generally higher during the post – crisis period especially during 2008 and 2009 sub-period, when the last global crisis was at its peak. While the correlation co-efficient between US S & P 500 and ASI reached its zenith in 2008; this was not the case with the other major markets in the study. Overall, there is an indication that during the 2008 and 2009 period, the crisis influenced the conditional correlation co-efficients between the three major markets and Nigeria; but while the relationship between the U.S. market and Nigeria was a case of pure contagion, this was not the case with the other pairs in the analysis. This conclusion was further substantiated by the correlation test result which indicated a pure contagion between the U.S. and Nigerian stock markets as evident from the absolute  $t = -4.750$  or  $-3.923$  ( $|t| > 2.576$  Two tail test) for adjusted and unadjusted correlations respectively.

## 6.0 CONCLUSION AND RECOMMENDATIONS

Due to the establishment of a significant change in the relationship between the U.S. and Nigerian Stock market and the volatility in the latter following the 2008 – 2009 global financial crisis, the conclusion is that there was a case of contagion between the U.S. and the Nigerian stock markets. But this was not the case with the United Kingdom and Japanese stock markets with the Nigerian stock market, although, conditional correlations were equally established between them and the Nigerian market, the absolute  $t = -1.462$  (Adj. Corr. ) or  $-1.277$  (Unadj. Corr.) and  $t = 0.449$  (Adj. corr.) or  $0.408$  (Unadj.) for rFTSE100 and rNIKKEI225 respectively were less than the level of statistical significance required ( $|t| < 2.576$  Two tail tests); hence, the cross-market linkages between the United Kingdom and Japanese stock markets with the Nigerian stock market were cases of mere interdependence.

It is hereby recommended that investors should take advantage of the diversification opportunities which still abound in the Nigerian stock market due to its low correlation with the United Kingdom and Japanese markets. This is quite unlike the case of high correlation between the U. S. market and the Nigerian stock market which has, therefore, limited opportunities which has limited the opportunities for diversification in

the latter market. The implication of this is that there is free flow of investment funds between the U.S. market and the Nigerian market.

Policy makers should strive to formulate policies that will lead to greater market integration between other major international markets not considered in this study and the Nigerian market as such will lead to greater availability of investment funds to the Nigerian stock market which is still evolving. This can be done through further liberalization of the economy through trade and further relaxation of capital controls.

Academicians should research into the cross-market linkages between other major trading partners such as China, Canada, the European Union other than the United Kingdom and Japanese markets, among others, in order to establish the cross-market linkages between these markets and the Nigerian stock market in both periods of crisis and tranquillity in order to provide understanding for the nature of linkages which exist. This has become imperative as the Nigerian stock market continue to evolve.

## REFERENCES

- Adamu, A. (2010). Global Financial Crisis and Nigerian Stock Market Volatility. *Nigerian Accounting Horizon*, 4(2), 154 – 167.
- Ali, R. & Afzal, M. (2012). Impact of Global Financial Crisis on Stock Markets: Evidence from Pakistan and India. *E3 Journal of Business Management and Economics*. 3 (7), 275 – 292.
- Alimi, A. S. & Adediran, I. A. (2018). The Nexus between Stock Market Prices and External Shocks: Evidence from Nonlinear ARDL on Selected Firms in the Nigerian Stock Market. *Global Journal of Management and Business Research*, 18(1), 1 – 59.
- Bai, J. & Pierre, P. (1998). Estimating and Testing Linear Models with Multiple Structural Changes. *Econometrica*, 66, 47 – 78.
- Bai, J. & Pierre, P. (2003a). Computation and Analysis of Multiple Structural Change Models. *Journal of Applied Econometrics*, 18(1), 1 – 22.
- Bai, J. & Pierre, P. (2003b). Critical Values for Multiple Structural Change Models. *The Econometrics Journal*, 6(1), 72 – 78.
- Bekaert, G., Harvey, C. R. & Lundblad, C. T. (2003). Equity Market Liberalization in Emerging Markets. *The Journal of Financial Research*, 26(3), 275 – 299.
- Bergmann, D. R., Securato, J. C., Savoia, J. R. F., Contani, E. A. D. R. (2015). U.S.A. Subprime Financial Crisis Contagion on BRIC and European Union Stock Markets. *Revista De Administracao*, 50(2), 229-240.
- Chong, C. C. (2011). Effect of Subprime Crisis on U.S. Stock Market Return and Volatility. *Global Economy and Finance Journal*. 4(1), 102 – 111.
- Dajcman, S. (2013). Forbes and Rigobon's Method of Contagion Analysis with Endogenously Defined Crisis Period – an Application to some of Eurozone's Stock Markets. *Inzinerine Ekonomika-Engineering Economics*, 24(4), 291 – 299.
- El Ghini, A. and Saidi, Y. (2013). Financial Market Contagion during the Global Financial Crisis: Evidence from the Moroccan Stock Market. [http://mpa.ub.uni-muenchen.de/53490/MPRA Paper No. 53490](http://mpa.ub.uni-muenchen.de/53490/MPRA_Paper_No.53490). Retrieved on the 22<sup>nd</sup> of January, 2019 at 2.00pm
- Forbes, K. & Rigobon, R. (1999). No Contagion, Only Interdependence: Measuring Stock Market Co-Movements. *The Journal of Finance*, 57(5), 2223 – 2261.
- Gharsellaoui, M. (2013). Subprime Crisis and Financial Contagion: Evidence from Tunisia. *International Journal of Economics and Financial Issues*. 3(1), 153 – 162.
- Kilic, O., Chelikani, S. & Coe, T. (2014). Financial Crisis and Contagion: The Effects of the 2008 Financial Crisis on the Turkish Financial Sector. *International Journal of Applied Economics*, 11(2), 19 – 37.

- Lee, J. & M. Strazicich (2003). Minimum Lagrange Multiplier unit root test with two structural breaks; *The review of Economics and Statistics*, 85, 1082-1089
- Lee, J. & M. Strazicich (2004). Minimum Lagrange Multiplier unit root test with one structural breaks, Department of Economics, Appalachian State University, Unpublished Manuscript
- Li, R. Y. M. & Li, J. (2013). The Impact of Subprime Financial Crisis on Canada and United States Housing Market and Economy. *ICBMCR Conference*, 59, 1 -6. DOI: 10.77763/IPEDR. V57.9. Retrieved from <https://www.researchgate.net/publication/256055728>
- Longin, F. & Solnik, B. (1995). Is the correlation in International Equity Returns Constant: 1960 – 1990? *Journal of International Money and Finance*, 14(1), 3 – 26.
- Masih, R. & Masih, A. M. M. (2001). Long and short term dynamic causal transmission amongst international stock markets. *Journal of International Money and Finance*, 20, 563-587.
- Miles, W. (2002). Financial Deregulation and Volatility in Emerging Equity Markets. *Journal of Economic Development*, 27(2), 113 – 126.
- Ncube, G. & Mingiri, K. F. (2015). Stock Market Integration in Africa: The Case of the Johannesburg Stock Exchange and Selected African Countries. *International Business & Economics Research Journal*, 14(2), 367-386
- Nicklas, S. & Thong, J. (2012). International Equity Correlations, Integration and Contagion: Semantic Scholar <http://ssrn.com/abstract=2146084>. Retrieved on the 10<sup>th</sup> of February, 2019 at 12:00pm.
- Njiforti, P. (2015). Impact of the 2007/2008 Global Financial Crisis on the Stock Market in Nigeria. *CBN Journal of Applied Statistics*, 6(1), 49 – 68.
- Nwude, E. C. (2012). The Crash of the Nigerian Stock Market: What went Wrong, The Consequences and the Panacea? *Developing Country Studies*, 2(9), 105 – 118.
- Ogbebor, P. I. (2018). The Relationship between Financial Market Liberalization, Stock Market Performance and Economic Growth in Nigeria. *UNILAG Journal of Business*, 4(2), 189 – 204.
- Olowe, R. A. (2009). Stock Return, Volatility and the Global Financial Crisis in an Emerging Market: The Nigerian Case. *International Review of Business Research Papers*, 5(3), 377 – 398.
- Oluwole, F. O. (2014). Globalization and Stock Market Growth in Nigeria. *European Scientific Journal*, 10(31), 317 – 332.
- Onuoha, T. E. & Nwaiwu, J. N. (2016). Impact of Global Financial Crisis on Nigerian Stock Market. *African Research Review*, 10(1), 166 – 177.
- Quaye, I., Mu Y., Abudu.B & Agyare, R. (2016) Review of Stock Markets Reaction to New Trends: Evidence from Brexit: *Journal of Financial Risk Management*, 5(4).
- Singhania, M. & Anchalia, J. (2013). Volatility in Asian Stock Markets and Global Financial Crisis. *Journal of Advances in Management Research*, 10(3), 333 – 351.
- The International Bank for Reconstruction and Development/The World Bank (2009). *Global Monitoring Report: A Development Emergency*. Washington D. C. The World Bank.

Ujunwa, A., Salami, O. P. & Umar, H. A. (2011). The Global Financial Crisis: Realities and Implications for the Nigerian Capital Market. *American Journal of Social and Management Sciences*, 2(3), 341 – 347.

