Stock Market Linkage, Financial Contagion and Assets Price Movements: Evidence from Nigerian Stock Exchange

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Abstract

This paper studied portfolio-investments diversification, stock market linkage and negative integration in Nigerian stock exchange. Like many other stock exchanges around the world, Nigerian stock exchange was devastated by the global financial crisis of 2008. That single crisis has changed the mode of operations of the market by affecting market capitalisation, efficiency and profit. Ten stock market indices are involved in this study, where the aim is to find out how Nigerian stock markets relate with counterparts around the world. The study covered the period from September 2009 to August 2016. The study used Generalised Impulse response function, Engel-Granger cointegration and Johansen cointegration analysis to measure integration between Nigerian stock exchange and selection of nine stock exchanges around the world. The results from cointegration analysis show lack of cointegration. This means despite globalisation Nigerian stock exchange is less integrated with the rest of the stock markets providing ample opportunities for portfolio diversification. This also further support previous studies that found out that developed countries stock markets tend to correlate with their developed countries counterparts than emerging and developing markets.

Keywords: Integration, Linkage, Contagion, Portfolio, Cointegration, Impulse response, Comovement, Stock markets, International finance

Introduction

There is increased in the level of integration among the developed stock market of the world, for example, Jawadi and Arouri (2008) found strong evidence of integration between US and French stock markets. Thus, it is logical for investors in advanced economies of the world to look for alternative sources of investment in the emerging markets in order to satisfy the urge to diversify their investment portfolios. International portfolio investments have made it possible for investors to participate in the growth of other countries via acquisition of securities in foreign capital markets such as emerging markets of Europe, Latin America, Asia, the Mideast and Africa (Bartram and Dufey, 2001). While more integration means more efficiency and lower cost of operations for stock exchanges around the world, on the other hand it signifies low opportunities for diversification of investments.

Stock market integration is of interest to 'investors and policy makers' (Agyei- Ampomah, 2011). Investors are interested in it because the more markets are integrated the less the opportunities for diversification, while policy makers are interested because of contagion effects from one market to another. Financial liberalisation itself is seen as the major driver of economic integration around the world; with it attendant benefits of reducing volatility, and enhancement of level of information efficiency in emerging markets (Rejeb and Boughrara, 2015). Stock market integration is linked with enhancing competition and efficiency in allocation of resources, promoting domestic savings, investment, and economic growth (Kapingura, Mishi, and Khumalo, 2014). But, increased linkages also have its negative side, it makes it easier for financial contagion to spread from one market to another (Awokuse, Chopra, and Bessler, 2008). It also reduces the opportunities for portfolio diversification.

Emerging financial markets are continuously being affected by changes taking place in the developed economies (Cakan, Doytch, and Upadhyaya, 2015). Where happenings in markets such as New York, London, Tokyo, and Paris stock exchanges are quickly felt in the emerging markets of the world. Financial liberalisation, for example, has short run negative effects which include wave of financial crisis (Trivedi, and Birau, 2013, Rejeb and Boughrara, 2015). A prominent example is the Asian financial crisis of 1996/7 which devastated the newly liberalised Asian emerging economies. What in financial literature is referred to as contagion is simply 'increase in correlations between financial markets in times of financial crisis compared to the relative stability periods' (Rejeb and Boughrara, 2015; Ghini and Saidi, 2015). There are many academic studies conducted in the past to find out why stock markets around the world crashed at the same time; most of these studies reached the conclusion that financial crises are contagious.

What is today called Emerging Markets are fast growing markets like Mexico, Turkey, Brazil, Malaysia, South Africa, and Thailand; small in terms of market capitalization and number of stocks in their respective IFC index compared to markets in developed countries, but, do not only offer high returns, but the risks associated with investments in them are higher than in

established markets (Bartram and Dufey, 2001). Nigeria has recently attracted a lot of interest from around the world due to reasons that include the growing importance of its economy, size of its domestic markets, and growth in its financial sector. According to Uyaebo, Atoi and Usman (2015), since the liberalisation program of Babangida (military) government that led to the deregulation of the Nigerian economy in 1986 and the subsequent liberalization of the capital market, Nigerian stock market has been linked to the rest of the world stock markets. Particularly, the authors observed capital importation from Kenya, South Africa, China, United States and Germany constituted an average of 72.02 per cent of the total capital importation into the economy with China alone contributing significantly to it.

The main objective of this work is to study the relationship between Nigerian stock exchanges and sample of nine other stock exchanges around the world with the aim of finding out the direction and volatility of movements between their respective indices and the Nigerian stock exchange. This is due to the research importance in study of Assets prices movements, international diversification and financial contagion. But, the specific objectives include:

i. Analysis the long run relationship between Nigerian stock exchange (NSE) and selected stock exchanges around the world
ii. Examine the dynamic effects of foreign stock exchanges on Nigerian stock exchange
iii. Study the movements of financial assets across major stock markets

Theoretical Framework

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Bartram and Dufey (2001), defined portfolio decision as: how to allocate wealth to financial and/or real assets so as to maximize the most desirable return, i.e. consumption in the future, assuming that consumption and productive investment decisions have already been made and thereby omitting potential feedback effects. It is good at this point to differentiate between portfolio investment and foreign direct investment. IMF and OECD see Direct Investment "as a lasting interest by a resident entity of one economy (direct investor) in an enterprise that is resident in another economy (the direct investment enterprise). The 'lasting interest' implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and a significant degree of influence on the management of the latter" (Duce and Espana, 2003). Portfolio investment, on the other hand, is defined as cross-border transactions and positions involving equity or debt securities, other than those included in direct investment or reserve assets (IMF).

The main rationale for international portfolio diversification is that it increases opportunities for benefiting from portfolio diversification beyond what is offered by domestic securities (Butler, and Joaquin, 2001). Bartram and Dufey (2001) sum up the attraction of participation in international portfolio diversification as (a) participation in the growth of other (foreign) markets, (b) hedging of the investor's consumption basket, (c) diversification effects

and, possibly, (d) abnormal returns due to market segmentation. In international finance literature, the traditional case for international diversification benefits, argued Christoffersen, Errunza, Jacobs, and Jin (2010), has relied largely on existence of low cross-country correlations, but now the focus has largely shifted to the diversification benefits offered by emerging markets away from the previous reliance on developed markets.

Correlation between stock returns in emerging markets and returns from developed markets provides opportunities for diversification, the efficient frontier of a portfolio that considers both markets dominate the one that considers only the developed markets, while return on investment in emerging markets is higher than in developed markets, but emerging stock markets are riskier than the developed stock markets (Harvey, 1995; Derrabi and Leseure, 2002). International stock market co-movement pattern is an important aspect in the theory of international portfolio diversification, according to Rehman and Shah (2016) due to its practical applications in asset allocation and risk management. Previous works on international portfolio investments show that developed markets have an average correlation with other developed markets that is higher than the average correlation obtain with emerging markets, and for emerging markets the correlation with developed markets is generally higher than the correlation with emerging markets peers (Harvey, 1995; Christoffersen, Errunza, Jacobs, and Jin, 2010).

In the financial literature stock market integration is theorised to leads to gains in efficiency than segmented national markets (Click and Plummer, 2003). The term "stock market integration", according to Marashdeh (2005), 'refers to an area of research in financial economics that covers many aspects of the interrelationships across stock markets'. Markets are said to be integrated if they share a common trend, that is to say, if they move together (Arouri and Jawadi, 2009). A more integrated stock market is more appealing to investors from outside the region of the market as it increases ease of doing business and boost total market capitalisation (Click and Plummer, 2003). Stock market integration, if it occurred at the right pace and in a pragmatic way, could improve the liquidity, efficiency, and competitiveness of exchanges involve (Irving, 2005). The degree of financial integration depends among other things, on 'internal and external factors: international, regional and specific economic, financial and political variables' (Arouri and Jawadi, 2009). But, another form of integration is contagion which is a negative integration, defined by Bekaert, Harvey, and Ng (2005) 'as correlation between markets in excess of that implied by economic fundamentals'.

But, it is also argued that as international investment increases, the emerging markets of the world become more integrated with the rest of the world. Therefore, the degree of linkage with other markets increases, reducing diversification opportunities; which means an emerging market can only provide significantly enhanced diversification benefits for a relatively short period of time (Harvey, 1995; Chelley-Steeley, 2005). Some studies (Richards, 1995) suggest that stock exchanges around the world are not as integrated as some studies made us to belief, arguing that random walk component inherent in stock indices would preclude that from occurring. According to Bartram and Dufey (2001) global financial markets are not yet fully integrated and still lack market efficiency due to market imperfections such as taxes, investment restrictions, foreign exchange regulations, therefore, capital asset pricing models (CAPM) built on these

assumptions may not price securities in different markets correctly. In segmented capital markets unlike integrated markets, the cost of equity capital is related to the local volatility of that market. But, in integrated capital markets, the cost of equity capital traded is related to the covariance with global market returns (Bekaert and Harvey, 2000).

Like searching for profit making opportunities in the financial markets around the world, financial contagion has remained an elusive concept. Different scholars view the issue of contagion differently, mostly from their own idealistic perspectives. Scientifically, contagion is difficult to study since it is statistically difficult to test hypothesis of changes in correlation between quiet and turbulent periods (Bae, Karolyi, Stulz, 2003). There are statistical evidences that correlations among world markets have been increasing more especially during periods of volatile price changes, prompting investors to ask "where is (international) diversification when I need it?" (Bartram and Dufey, 2001). Some contagions are self-fulfilling crises: 'crises that occur just because agents believe they are going to occur' (Goldsteina and Pauzner, 2004). According to Raj and Dhal (2008), Economists have come to the realisation that it is useful for countries to monitor the progress of interdependence among financial markets because of policy as well as market participants' interests.

According to Butler and Joaquin (2001), correlations in Stock market are important due to the significant role they play in portfolio diversification. The literature on the topic argues that stock market correlations are high during market volatility, especially during financial crisis and stock market collapse like in the case of last global financial crisis when stock market became bearish worldwide from Asia to Europe, Africa and the US. While correlation is observed to be low during calm and bull markets (Butler and Joaquin, 2001; Moldovan, 2011). Despite the advantages brought about by globalisation, the incidents of financial crisis have spread from one country to another even among countries that are not linked by any economic fundamentals (Goldsteina and Pauzner, 2004). The fact that the same set of investors diversify their investment cross similar countries make spread of contagion easier because the realization of a financial crisis in one country can induce a crisis in the other countries as the same group of investors try to pull out of these countries where they diversify their holdings. Hence, the missing link between these nation, though not connected by any economic fundamental is sharing the same group of investors (Goldsteina and Pauzner, 2004).

Empirical Literature review

Arouri and Jawadi (2009) examined the monthly stock market indices of two emerging countries (the Philippines and Mexico) plus the world market over the period December 1988 – December 2008, in order to explore the financial integration hypothesis for the two emerging markets into the world stock market in a nonlinear framework. The econometric techniques they employed enabled them to reproduce the extreme cases of financial integration (perfect integration and strict segmentation) as well as a continuum of intermediate states relative to partial integration that characterizes most emerging stock markets. Khan (2011), examines long-run convergence between the United States and 22 other developed and developing countries

using daily data. He runs the Johansen (1988) and the Gregory and Hansen (1996) test to show that stock markets of most of the countries in the study have become cointegrated by 2010. He further looks at short-run diversification opportunities across these countries by comparing their daily returns to the daily returns of the global index (S&P 1200). His findings show that China, Malaysia and Austria stand out as countries with highly favourable diversification opportunities from the point of view of US investors.

Wang and Moore (2008), examines the extent to which a group of Central-Eastern European markets have become integrated with developed markets (represented by Eurozone market), using dynamic conditional correlation from the multivariate GARCH model. The authors find higher level of stock market correlation in the period after the Asian and Russian financial crises as well as after entry into the European Union. Making use of High frequency data (HFD), Ben-Ameur, Jawadi, Louhichi, and Cheffou, (2016) studies stock price comovements in the US, France, Germany and the UK. Their findings show that both European and US markets indices contributed to each other's systemic risk. Uyaebo, Atoi and Usman (2015) used the all share index of Nigeria, Kenya, South Africa, China, United States and Germany to estimate first order Asymmetric GARCH family models on Student's t and generalized error distribution (GED) in order to select the best stock market volatility models based on Akaike Information Criterion (AIC) with a view to comparing market volatilities. The results of the study reveal that volatility of Nigeria and Kenya stock returns react to market shock faster than in other countries, suggesting the absence of leverage effect in Nigeria and Kenya stock returns. Oloko (2016), examines portfolio investment diversification between developed and developing economies; with focus on the Nigerian stock asset vis-à-vis the stock assets of the United States and United Kingdom with the view to find any hedging effectiveness in the portfolio. The findings of the study show impressive potential gains from combining Nigerian stock assets in an investment portfolio with US and UK stock assets.

Abraham (2015) in a study, using trend analysis, on Nigerian and Ghanaian stock exchanges in the period November 2007 and May 2009 observed that Nigerian stock exchange is more volatile than Ghanaian stock exchange. He also used error correction model to measure integration level between the two regional markets. His findings show that though there is tendency for the NSE and the GSE to be cointegrated, distortions in the short run are not likely to be corrected in the long run to bring about integration. Using monthly return data covering the period from January 1998 to December 2007, a total of 120 months for ten African countries, Agyei-Ampomah (2011), employed method of correlation analysis and integration to quantify the contribution of regional and global market movements to local index volatility. He decomposed the volatility of the domestic index into three components; contribution of the regional index, contribution of the global and what he terms 'unsystematic' component. By this approach he was able to find that stock markets in Africa (with the exception of South Africa) were segmented from the global market, and that a large percentage of the total volatility of the local indices comes from country-specific factors.

Kambadza and Chinzara (2012), analysed the prospects of international portfolio diversification for South African investors in Africa. They examined long term comovement

between/among stock markets in Africa using Vector Error Correction Model (VECM). Their findings based on bivariate cointegration analysis indicate that seven out of twenty-eight models showed slim evidence of cointegration. The VECMs for these models revealed that positive long run relationships exist amongst the markets in each model. They also performed multivariate cointegration applying Johansen, including all the eight markets; the result showed one cointegrating vector amongst the exchanges, suggesting limited evidence of long run comovement. Early empirical works on financial contagion employed correlation analysis to measure co-movement between markets (Ghini and Saidi, 2015). The actions of stock markets during financial crisis is of interest to scholars of financial contagion, a paper by Assidenou (2011) looked at the cointegration of major stock market Indices during the 2008 global financial Distress. Basing his analysis on daily closing prices of international stock markets indices, the analysis shows that three set of indices of economies (OECD group, Pacific group and Asia group) have at least one cointegrating vector during the period of the study.

Using bivariate DCC-GARCH model Ghini and Saidi (2015), test contagion effects of the US subprime crisis on the Moroccan market. The study investigates the comovements between Moroccan and French, German, British, as well as US stock markets over the period of 2002–2012. The findings of the study show that bad news about economic Partners (French, German, British, and US) of Morocco generated contagion in the local stock market. This show increase connection between Moroccan market and others. In a paper on financial contagion in the emerging markets, Bae, Karolyi, and Stulz (2003) found mix evidence that contagion is stronger during extreme negative returns than during extreme positive returns, they also find evidence of cross-regional contagion. The authors adopted multinomial logistic regression model for the study which concluded that 'contagion is predictable and depends on regional interest rates, exchange rate changes, and conditional stock return volatility', (Bae, Karolyi, and Stulz, 2003). Their work has the advantage of considering contagion within regions as well as across regions. Correlations within regions, the authors noted, are higher than correlations across regions. They further conclude that Contagion is more important in Latin America markets than in Asian, Contagion from Latin America to other regions of the world is more important than contagion from Asia to other regions, and that Contagion is predictable conditional on prior information.

Methodology

Types and Sources of Data:

Data use for this study are secondary data, obtains through Nigerian stock exchange and Yahoo Finance. The data on Nigerian stock index was obtained through Nigerian stock exchange, while all the remaining data on stock indices used in the study were obtained from Yahoo finance. The data consist of closing price of monthly stock indices quoted in local currencies of the respective stock markets over the period of the study. The fact that world's capital markets indices reflect the level of intensity of capital flows between countries, explains

the reasons why the work is on different financial markets indices of countries around the world and show potential explanations of their correlations.

The study covers the period starting from September 2009 to August 2016. Data used for the study is Monthly Share Index. The study takes regional indexes from South Africa (South Africa), North America (Mexico), South America (Brazil), Asia (India, China, and Indonesia), Europe (Turkey, Germany and France) and compared them with Nigeria's NSE. It also attempts to correlate NSE performance with these markets in order to capture the degree of integration with the major global stock markets. Using Johansen cointegration method, and correlation analysis the study seeks to find dynamic linkages between Nigerian stock exchange and the selected group of markets around the world.

Monthly data is used in this work in order to avoid the problem of non-synchronous trading, so common in emerging markets data, as well as the problem of 'autocorrelation in volatility', a feature of high frequency data such as Daily or Weekly Prices (Alagidede, 2008). Some previous studies in this area (Raj and Dhal, 2008; Alagidede, 2008; Tabak and Lima, 2002; Assidenou, 2011) made use of stock indexes in US Dollar to allow for international comparisons. But, other studies like Click and Plummer (2003) used local currencies, at the same time others (Heilmann, 2010) used both the Dollar and local currencies. The present study uses local currencies and where data is not available in local currency its dollar equivalent was used. Indices expressed in local currency help evade problems associated with transformation due to fluctuations in cross-country exchange rates and assumptions related to Purchasing Power Parity (Dimitriou and Kenourgios, 2012).

Method of Analysis:

Methods used for the analysis are Johansen's (see Johansen, 1990, 1991) and Engel-Granger cointegration methodologies to test the relationships between Nigerian stock exchange and the other markets.

Unit Root Tests:

Before any cointegration analysis of time series data, the univariate properties of the stock index data shall be examined to know whether the data series are nonstationary, or contain a unit root. The test popular in applied econometrics is utilized here: The Augmented Dickey-Fuller (ADF) tests.

Lag Length Tests:

The number of lags length use in the unit root tests is chosen using the Akaike Information Criterion (AIC). Our objective here is to choose the number of parameters, which minimizes the value of the information criteria.

Cointegration Test:

In cointegration analysis, Error correction model (ECM) was employed because of its strength in providing estimates for short-run and long-run relationship in a single equation. According to Dimitriou and Kenourgios (2012) cointegration may exist for variables despite the fact that the underlying variables are individually nonstationary. Meaning that a linear combination of two or more time-series can be stationary and there is a long-run equilibrium between them. Hence, the regression on the levels of the variables is significant and not spurious. Text book economics believe that in the long run it is not possible to get the so called abnormal profit through cointegration, as presence of cointegration will diminish the opportunity for making arbitrage profit. This study will try to find out whether it is possible to make abnormal profit in the long run by means of portfolio diversification between Nigerian stock exchanges and the selected markets.

Where these stock markets are found to be cointegrated in the econometric sense, we can then proceed to say that they are integrated in the economic sense. This will occur where correlations of returns converge to unity meaning there is no diversification potential in the long run and the individual stock markets are completely and perfectly integrated. This scenario will mean absence of diversification benefits between the markets in the study. The Johansen procedure tests for cointegration in the absence of any structural break in the data this explained our decision to take our starting date from 2009 in order to avoid the global financial crisis of 2008.

Define X_t as a set of I (1) variables consisting of n stock indices. A VAR(k) model, can be

expressed as;

$$X_t = \mu + A_1X_{t-1} + A_2X_{t-2} + \ldots + A_kX_{t-k} + e_t \qquad (1)$$

where A_k is an n × n coefficient matrix, t = 1, 2, ..,T and e_t is a random error term. It Error Correction Model or differenced form is

$$\Delta X_t = \mu + \sum_{i=1} \Gamma_i \Delta X_{t-i} + \Pi_i X_{t-k} + e_t \quad (2)$$

where Δ is the first difference operator, Γ is an n × n coefficient matrix, defined as $\Gamma_i = -(I - A1 - ... - A_i)$, which represents the short-run dynamics, and Π is an n × n matrix defined as $\Pi = -(I - A_1 - ... - A_k)$, where I is an identity matrix, whose rank determines the number of distinct cointegrating vectors.

The advantage of the methodology is essentially in determining the rank of the matrix Π. If Π has rank r, then there are r cointegrating relationships between the X_t or n - r common stochastic trends. The number of cointegrating vectors reveals the extent of integration across stock markets. If n - r = 0 (r = n) (full rank), we have the absence of any stochastic trends, with all elements in X_t being stationary [I (0)] and cointegration is not defined. If n - r = n (r = 0) there are no stationary long-run relationships among the elements of X_t. This latter statement has implications for diversification across international equity markets, since a common trend implies relatively high cross-market correlation, thereby diluting any potential diversification benefit over the long-run. Reduced rank (n > n-r > 0) indicates the existence of at least one common stochastic trend, thus, there will then exist n × r matrices α and β such that $\Pi = \alpha \beta'$. The β matrix gives the cointegrating vectors, while α gives the amount of each cointegrating vector entering each equation of the Vector Error Correction Model (VECM), also called the adjustment matrix. A finding of reduced rank implies that, while long-run integration is not complete, the convergence process is ongoing, with the number of independent stochastic trends indicating the extent of the convergence and any diversification and institutional issues arising from it.

Generalised Impulse Response Functions:

Impulse response functions are used to measures the effects of shocks in one stock market into the other markets. This help us identify the effect of economic and financial shocks from other economies and markets on the Nigeria stock exchange, from there be able to know whether financial contagion can easily spread into the Nigerian stock exchange (NSE) from elsewhere. Here it is computed the dynamic response of each market return series to random

shocks in the other markets. This shows how unexpected changes in each market return changes the returns of other markets.

Results and Discussion

Stock Indices statistics:

The stock index use for the Nigeria stock exchange is the All Share Index (ASI); for Paris Stock exchange, Paris CAC40; for Bombay stock exchange India, BSE SENSEX; for Frankfurt stock exchange, XTRADAX; MXN for Mexico stock exchange; for Shanghai stock exchange, SSE composite index; in case of Jakarta stock exchange, Jakarta composite index; Saopaolo stock exchange the BVSP is adopted; finally, for Johannesburg stock exchange the index JSEJF is our sampled index. Looking at the standard deviations of the indices, Istanbul is the most volatile stock markets in the study followed by Saopaolo, Nigeria is the third most volatile market in the study during the period. While South Africa is the least volatile market followed by Paris stock exchange.

Table 4.1: Summary of Descriptive Statistics

Statistics	NSE	JSE	BSE	IST	CAC	XTR	SHA	MXN	SAO	JAK
Mean	28898	9.37	21346	69556	4012.4	8216.2	2679.7	39891	56819	4225.2
Median	26830	9.32	19504	71727	3989.1	7795.3	2638.8	40799	56352	4316.0
Maximum	42561	12.2	29220	88945	5082.6	11966	4611.7	47563	70673	5518.5
Minimum	20003	7.20	15454	45350	2981.9	5414.9	1979.2	28646	40406	2367.6
Std. Dev.	6539.6	1.22	4283.5	11058	529.16	1871.0	562.98	4795.2	7409.6	815.70
Skewness	0.5722	0.38	0.5128	-0.244	0.0952	0.2020	1.1137	-0.550	0.0672	-0.607
Kurtosis	2.1226	2.39	1.7153	2.0359	2.2191	1.7232	4.4831	2.3349	2.1811	2.5650
Jarqu-Bera	7.3657	3.42	9.5711	4.1377	2.2880	6.3518	25.363	5.8663	2.4390	5.9013
Probability	0.0251	0.18	0.0083	0.1263	0.3185	0.0417	0.0000	0.0532	0.2953	0.0523
Sample(N)	85	85	85	85	85	85	85	85	85	85

Source: authors calculations

Test for Unit Root

The empirical investigation of the relationship between time series data such as equity market's monthly closing price shall begin with testing for the presence of unit roots. Our test for unit root by means of augmented dicker fuller (ADF) test shows that all the ten stock exchanges index data are stationary at first difference I (1); therefore, satisfying the condition necessary for using Johansen cointegration analysis in measuring stock market comovements. Therefore, cointegration analysis is a valid method for studying the stochastic behaviours in the system, or that of any pair of the series. The evidence provided here is based on the Johansen (1991, 1995) and Engel Granger cointegration test to investigate the degree of linkage among the ten markets in the study.

Table: 4.4 Unit Root Tests

Variable	**ADF Test Statistic**	**Critical Value (1%)**	**Remark**	**Prob. (ADF)**
NSE	-7.330897	-3.511262	1(1)	0.0000
BSE	-10.07758	-3.511262	1(1)	0.0000
CAC	-9.400069	-3.511262	1(1)	0.0000
IST	-8.824121	-3.511262	1(1)	0.0000
JAK	-8.629715	-3.511262	1(1)	0.0000
JSE	-10.83249	-3.511262	1(1)	0.0001
MXN	-9.633386	-3.511262	1(1)	0.0000
SAO	-8.756235	-3.511262	1(1)	0.0000
SHA	-6.876264	-3.511262	1(1)	0.0000
XTR	-8.623157	-3.511262	1(1)	0.0000

Source: Author's calculation on stock indices data using Eview 8

Cointegration Test

Result of cointegration test using Johansen cointegration method show that Nigerian stock exchange is weakly cointegrated with the sample of nine stock markets (see appendix 3). Lack of cointegration mean that there are long term arbitrage opportunities between NSE and these markets. Thus, just like the findings of many other studies reviewed in the literature in connection with NSE, Nigerian stock exchange is still segmented from the rest of the world. The use of Engel-Granger Cointegration method show no single cointegration between the NSE and each of the nine stock market indices that was faired with the NSE index (see Table below and Appendix 4). The Johansen cointegration results suggest that there are minimum independent linear combinations of the vector of stock price series, Xt, that are stationary for the set of markets we examine during the period 2009 to 2016. The evidence of minimum stochastic trend suggests that the pace of integration is slow and at best possibly driven only by the bigger markets. This provides further proof that the Nigerian stock exchange is segmented from other major stock exchanges around the world. On the other hand, this result is good for international portfolio diversification, as Nigeria will be good for inclusion in any investment portfolio with

the purpose of risk diversification. This result is particularly useful in the context of the earlier finding of negative or low correlation between Nigerian stock exchange and these markets.

Table: 4.5: Summary of Engel-Granger Cointegration Tests

	Z(t)	p-value
1. NSE-XTR	-4.3742	0.7769
2. NSE-MXN	-3.2028	0.8637
3. NSE-SAO	-6.8465	0.5703
4. NSE-SHA	-3.9334	0.8113
5. NSE-JSE	-3.5545	0.8394
6. NSE-JAK	-4.4989	0.7668
7. NSE-IST	-7.5118	0.5167
8. NSE-CAC	-5.5771	0.6770
9. NSE-BSE	-4.4793	0.7684

Source: Author's analysis on stock indices data by means of Eview8

Generalised Impulse Responses Test

Summary of impulse responses are reported in the table below and Appendix 1. The result from impulse response analysis show that Nigerian authorities shall be more concerned with shock originating from within the economy than one coming from abroad. The market response to its own self started positive, persist, and moved up. The NSE response to other markets started low at the first period but later on rise. NSE response to BSE, CAC, IST, MXN, SAO, and XTR was all positive and persistent, while response to JAK was low and insignificant. NSE response to JSE started positive around zero but died down and then became negative and persistent. The highest positive response of NSE to any market was to XTR, while the highest negative was to JSE and SHA. Overall, NSE seem to response more to itself than to any outside market, while response to other markets started low but persisted. The level of sensitivity to shocks from other markets was related to the degree of openness and to the nature of macroeconomic coordination between countries. The results of the impulse response functions give further evidence that Nigerian stock market did not appear to have strong links.

The findings of the results may be attributed to a low level of policy coordination between Nigeria and these countries. Although there have been trade linkages between Nigeria and these markets for many years the evidence presented here indicates that the ten markets would have to establish institutional agreements on equity markets. The exchange rate mechanism that might increase closer relationship among these economies has not yet been harmonized. Therefore, intensive trade and other cooperation among their national governments is required to remove obstacles that inhibit the flow of investment funds between Nigeria and them. The weak linkage observes may also be as a result of the lower level of bilateral trade. Normally, direction of trade is influenced by factors such as abundant of natural resources, population size, political relation, level of economic development, and colonial ties. Thus, not only is equity market integration weak, but also overall economic integration seems to be week with some of these countries.

Conclusion

The study analysed the level of linkage that exist between the Nigerian Stock Exchange (NSE) and sample of nine other stock exchanges around the world. This is done in order to find out whether it is possible for investor from these nine stock markets to diversify his stock holding by including the NSE in his portfolio and to discover negative linkages. The data used for the study is time series data, dated September 2009 to August 2016 sourced from Yahoo Finance and Nigerian Stock Exchange. The study used Generalised Impulse response function to test short run relationships between the markets, and the popular Johansen's Cointegration method and Engel-Granger cointegration to measure the long run linkage. The study shows that lack of cointegration of the Nigerian stock exchange with the rest of the world signifying lack of efficiency of the Nigeria stock exchange according to the literature in this area. Despite the apparent diversification advantages of this. The study could not establish any long run relationship between Nigerian stock exchange and other stock markets in the study. Likewise, short run relationship was found to be weak.

The results from Johansen cointegration analysis show that there is three cointegration vectors. This means despite globalisation Nigerian Stock Exchange is less integrated with the rest of the markets in the study providing ample opportunities for portfolio diversification for foreign investors coming into the Nigerian market. The same lack of cointegration was found when NSE is cointegrated with each one of the nine stock exchanges using Engel-Granger cointegration method. This also further support previous studies that found out that developed countries stock markets tend to correlate with their developed countries counterparts than with the ones in emerging markets.

It is clear that any external shock to the Nigeria stock exchange can only come indirectly through what is happening in the Nigerian domestic economy but not directly through foreign markets. It is found that the low levels of correlation between the NSE and global market reported in the previous studies still persist. Apart from the weak correlation found in the correlation analysis conducted, the study does not find any evidence that Nigerian capital markets is integrated with the global stock market. Thus, there are stronger diversification benefits in the Nigerian stock markets for fund managers within and outside the emerging markets of the world, if perceptions of African stock markets would change. Although, significant costs and constraints remain in the market, significant reforms are still being pursued to enhance transparency in market transactions and liquidity.

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APPENDICES

Appendix 1: Impulse response functions for volatility linkages

Appendix 2:

Johansen Cointegration Test

Date: 03/31/17 Time: 10:30
Sample (adjusted): 2010M05 2016M09
Included observations: 77 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: NSE BSE CAC IST JAK JSE MXN SAO SHA XTR
Lags interval (in first differences): 5 to 7

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.672758	364.3299	251.2650	0.0000
At most 1 *	0.641978	278.3167	208.4374	0.0000
At most 2 *	0.500956	199.2254	169.5991	0.0005
At most 3 *	0.440080	145.7056	134.6780	0.0095
At most 4	0.384692	101.0486	103.8473	0.0755
At most 5	0.301037	63.65484	76.97277	0.3335
At most 6	0.248627	36.07673	54.07904	0.6705
At most 7	0.098037	14.06605	35.19275	0.9708
At most 8	0.073746	6.121050	20.26184	0.9447
At most 9	0.002883	0.222350	9.164546	0.9999

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.672758	86.01318	65.30016	0.0002
At most 1 *	0.641978	79.09135	59.24000	0.0002
At most 2 *	0.500956	53.51974	53.18784	0.0462
At most 3	0.440080	44.65706	47.07897	0.0888
At most 4	0.384692	37.39373	40.95680	0.1193
At most 5	0.301037	27.57812	34.80587	0.2811
At most 6	0.248627	22.01068	28.58808	0.2744
At most 7	0.098037	7.944996	22.29962	0.9547
At most 8	0.073746	5.898701	15.89210	0.7992
At most 9	0.002883	0.222350	9.164546	0.9999

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values