“Correlation of stock market returns in the West African region from 2008 to 2016”

AUTHORS	Eseosa Obadiaru https://orcid.org/0000-0002-9678-2486 Alex Omankhanlen Barnabas Obasaju https://orcid.org/0000-0003-2003-6599 Henry Inegbedion https://orcid.org/0000-0003-1941-0715

ARTICLE INFO	Eseosa Obadiaru, Alex Omankhanlen, Barnabas Obasaju and Henry Inegbedion (2019). Correlation of stock market returns in the West African region from 2008 to 2016. *Investment Management and Financial Innovations*, *16*(3), 120-130. doi:10.21511/imfi.16(3).2019.12
DOI	http://dx.doi.org/10.21511/imfi.16(3).2019.12
RELEASED ON	Thursday, 22 August 2019
RECEIVED ON	Thursday, 10 January 2019
ACCEPTED ON	Wednesday, 19 June 2019

LICENSE	This work is licensed under a Creative Commons Attribution 4.0 International License

JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
27	0	13

© The author(s) 2026. This publication is an open access article.

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Eseosa Obadiaru (Nigeria), **Alex Omankhanlen** (Nigeria),
Barnabas Obasaju (Nigeria), **Henry Inegbedion** (Nigeria)

CORRELATION OF STOCK MARKET RETURNS IN THE WEST AFRICAN REGION FROM 2008 TO 2016

Abstract

Stock markets over the world have become more interconnected due to activities of foreign investors in search for alternative financial assets and markets to invest in order to diversify their portfolio. Stock market indices and index returns have been known to reflect linkages between different markets. This study assesses the extent of correlation of stock market index returns in West Africa and those of the United States of America (US) and United Kingdom (UK) from 2008 to 2016. The correlation between the index returns for the entire sample period and yearly samples were considered for Nigeria, Ghana, the BRVM, the USA and the UK. The indices selected for the five countries considered are the Nigerian All-Share Index, Ghanaian Composite Index, the BRVM Composite Index, the Financial Times 100 Index and the Standards and Poor's 500 Index. Daily index returns data were used for the study and analyzed using correlation and multiple regression analysis. Findings revealed that the returns of the pairs of the United States of America (US) and the United Kingdom (UK) exhibited stronger positive correlation with each other than the other market pairs in the study both in the entire sample period and the yearly sub-period analysis. The correlations between the other market pairs were either positively or negatively weak or very weak indicating more diversification opportunities.

Keywords stock market integration, index returns, West Africa, correlation, stock market movements

JEL Classification G15, F65, F36, D53, F02, F21, G15

Received on: 10th of January, 2019
Accepted on: 19th of June, 2019

© Eseosa Obadiaru, Alex Omankhanlen, Barnabas Obasaju, Henry Inegbedion, 2019

Eseosa Obadiaru, Lecturer, Department of Accounting and Finance, Faculty of Management Sciences, Landmark University, Nigeria.

Alex Omankhanlen, Ph.D., Department of Banking and Finance, Faculty of Business and Social Sciences, Covenant University, Nigeria.

Barnabas Obasaju, M.Sc., Department of Economics, Faculty of Business and Social Sciences, Landmark University, Nigeria.

Henry Inegbedion, Ph.D., Department of Business Administration, Faculty of Business and Social Sciences, Landmark University, Nigeria.

This is an Open Access article, distributed under the terms of the Creative Commons Attribution 4.0 International license, which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Stock markets are known as engines of economic growth across the world (Osaze, 2007; Aregbeshola, 2016). While stock markets serve as sources of funds to corporations in need of capital, they also provide income for investors in the form of dividend and capital gains from shares, as well create jobs for brokers, registrars and other market participants. Stock market indices could be used to assess the performance of stock markets, as they can depict if a particular market is experiencing an upward (bull) trend, which indicates a general increase in the value of shares or a downward (bear) trend, indicating a general decrease in the value of shares. Also from the market index, the returns on an index over a period of time can also be ascertained. While the index returns are relevant in assessing overall returns in a market or market segment, index funds are usually tied to particular market indices, thereby making the performance of the fund to be basically determined by the performance of the index.

Stock markets across the world have become more interdependent than isolated due to increasing levels of financial globalization and liberalization, internationalization and integration. The linkages between

http://dx.doi.org/10.21511/imfi.16(3).2019.12

stock markets can be reflected in the values of market indices and their returns. Studies abound that attest to interdependencies between equity markets include Donadelli (2014), Maggiora and Skerman (2009), Liu (2009), Berben and Jansen (2005), Aggarwal and Kyaw (2005), Lucey and Voronkova (2005), and Tan and Tse (2001).

In the West African region, there is an ongoing process of capital market *dejure* integration being fostered by the Economic Community of West African States (ECOWAS). The capital market integration drive is a part of the plan for economic integration in the region, which covers integration in functional areas including the monetary system, trade and finance. The three major stock markets in the West African region are those of Nigeria, Ghana and the West African Economic and Monetary Union (WAEMU), which are all classified as frontier markets by the Morgan Stanley Capital International (MSCI). The other markets in the region include those of Cape Verde, Sierra Leone, but are not considered in this study due to their size.

Empirical researches on interactions between the stock markets in the West African region viz a viz other markets in other regions are relatively few. Agyei-Ampomah (2011) is among the few studies that have empirically examined the correlation of index returns in Africa inclusive of the ECOWAS region. Assessing the extent of correlation of stock returns in different equity markets is pivotal if investors are to maintain portfolios with different returns and risk in a bid to gain from diversification opportunities. Frontier markets are increasingly being considered as alternative investment haven often generating high returns in the recent past. The extent to which returns from individual frontier markets in West Africa are correlated with other markets within and without the region in the light of recent regional cooperation efforts and changes in the global investment environment is unclear. This study is spurred by the need to clarify the nature and extent of the relationship between stock market returns in the West African region and beyond.

In order to achieve its objectives, this study explores some stylized facts on stock markets in the West African region and empirically analyzes the relationship between stock markets in the region viz a viz the stock markets of the United States of America (US) and the United Kingdom (UK). The study uniquely analyzes yearly sub-samples of daily returns to investigate the progression of integration between the selected equity markets using correlation. Multiple regression was used to further verify the nature of the relationship between the markets. The index data were obtained from various online sources, including African Markets, Ghana Annual Report, Financial Times and Yahoo Finance. The rest of the paper is structured into the empirical literature, stylized facts, data and methodology, empirical analysis, implications of findings and recommendations and lastly the conclusion.

1. EMPIRICAL LITERATURE

Empirical studies on the relationship between stock markets across the globe abound. A few of the studies that have studied the interactions between stock markets in the West African region include those of the West African Monetary Agency (WAMA, 2011), Mobolaji and Kedir (2012), Agyapong (2014). Other studies that have focused on the interactions between stock markets of selected countries in the African region and other countries outside Africa include studies of Obadiaru, Oloyede, Omankhanlen, and Eyiolorunshe (2018), Abdullahi (2017), Sahar and Shah (2017), Bundoo (2017), Aawaar (2017), Celik and Baydan (2015), Gail and Kapingura (2015), Gour'ene and Mendy (2014), and Agyei-Ampomah (2011). Studies that have focused of interaction between financial markets in developed countries outside Africa include Eun and Shim (1989), Kouretas (2011), Forbes and Chinn (2004), Ehrmann, Fratzscher, and Rigobon (2011), Bartram, Taylor, and Wang (2007).

Agyei-Ampomah (2011) assessed stock market integration in Africa from a regional and global perspective by analyzing monthly index returns from ten selected African countries, including but not limited to Nigeria, South Africa, Egypt, Ghana

and Ivory Coast. Correlation analysis was used and an integration score for assessing the contribution of regional and global market movements to local stock market volatility was utilized. Findings of the study revealed that the African markets are segmented from the global market, although an increasing level of integration with the global market was observed. Also, evidence of regional market integration across the African continent is not found, but rather the market seems to have become more segmented.

WAMA (2011) conducted a study on financial integration in West Africa. From the findings on the integration of capital markets, the relationship between the Bourse Régionale des Valeurs Mobiliéres (BRVM), the Nigerian Stock Exchange (NSE) and the Ghanaian Stock Exchange (GSE) was examined using quarterly index data from the first quarter of 2000 to the third quarter of 2010. The vector autoregression technique was used for the study and the results showed that there was no cointegration between the three stock markets. Meanwhile, the result of the banking sector was mixed.

Mobolaji and Kedir (2012) conducted an empirical study on financial integration and common investment market in ECOWAS. Investment data were used as a proxy for common investment market to assess the impact of financial integration on it. A linear panel one-way error component model was used. The regressors included GDP, financial development, proxies for financial integration and institutional policy, trade openness, financial, monetary policy, fiscal policy. The data spanned the period from 1980 to 2006. The results suggest that the openness of trade and finance has positive impacts on the investment environment of the region. The financial indicator variable did not perform well in the model, suggesting that the variable did not adequately capture the impact of financial integration in the region, or that the impact is not visible due to the low level of integration in the region.

Agyapong (2014) used both linear and nonlinear cointegration methods to examine the degree of integration of equity markets in the West African Monetary Zone (WAMZ). Findings from the linear cointegration revealed that the Ghanaian and the Nigerian stock exchanges were not integrated. The linear cointegration analysis though showed that the markets were weakly integrated. The fractional integration method revealed that while the Ghanaian stock market has infinite shock duration, that of Nigeria equity market is prolonged. The study did not cover the BRVM as such WAEMU sub-region of ECOWAS.

Besides examining the three major equity markets in the West African region, thus, covering the WAEMU countries, this study also includes two major global equity markets, thus, incorporating both a regional and global dimension to the study and attempts to fill the gap in the literature by investigating the relationship between the index returns of the selected markets. The study provides more recent empirical evidence on the extent of stock market integration in the West African region and how this has progressed with time by utilizing the simple correlation technique. Other more complicated techniques have been used in assessing stock market integration in West Africa as seen in Obadiaru, Oloyede, Omankhanlen, and Eyiolorunshe (2018) who examined the extent of mean and volatility spillover using the GARCH technique.

2. STYLIZED FACTS ON WEST AFRICAN STOCK MARKETS

2.1. Number of listed companies by sector

Table 1 shows the number of listed companies by sector in the BRVM, the Nigerian Stock Exchange (NSE) and Ghanaian Stock Exchange (GSE), respectively. The three major markets in the West Africa region both have their financial sub-sectors as the largest based on the number of listed firms with about 12, 14 and 62 listed firms in the BRVM, GSE, and NSE, respectively. This implies that more financial firms tend to come to the stock markets to raise funds. This may imply that the financial systems of these countries are bank-based, which could further be a reason why few firms from other sectors come to the stock market to raise funds, as they may rather source capital from the banks and other financial institutions listed on the stock market.

Similarly, the consumer goods sub-sectors of the three markets come as the second largest sub-sec-

http://dx.doi.org/10.21511/imfi.16(3).2019.12

tors with 10, 12, 27 firms in BRVM, GSE, and NSE, respectively. This is indicative of the high demand for consumable goods from the large population that the region is endowed with. The industrial sub-sector comes third in the BRVM and NSE with 9 and 25 firms, respectively, and the basic materials subsector in the GSE with 4 firms. Similarly, for the NSE and GSE, the technology sub-sector had the lowest number of listed firms with 7 and 1, respectively, while in the BRVM, the basic materials sub-sector came behind with 1 listed firm. Some sectors had no listed firms. Interestingly, the utilities and telecommunications sector has no listed firms in both the GSE and NSE, while the technology and health sector in the BRVM had no listed firms. The number of listed firms in the key sectors of technology, health and telecommunication reflects the level of development in the respective economies. This further possibly implies that these countries depend mainly on other countries to provide their local needs in these sectors. Another possibility is that most of the indigenous firms are small and not large enough to access funds from the stock market or are funded by stock markets in other countries (most likely more developed countries). Although, in general, some of the listed firms on the stock exchanges in the region have substantial foreign ownership both as portfolio and direct investment.

Table 1. Number of listed companies in the West African stock markets by sector

Source: Authors' computation (2019).

SECTOR	BRVM	GSE	NSE
FINANCIALS	12	14	62
INDUSTRIALS	9	2	25
CONSUMER SERVICES	3	3	14
UTILITIES	2	0	0
CONSUMER GOODS	10	12	27
TELECOMMUNICATIONS	2	0	0
OIL AND GAS	3	3	13
BASIC MATERIAL	1	4	12
HEALTH CARE	0	3	11
TECHNOLOGY	0	1	7

2.2. Number of listed companies and market capitalization in West African stock markets

Table 2 shows the proportion of listed companies in the ECOWAS region per market. The NSE has the largest number of listed companies with about 177 companies; GSE and BRVM with 42 companies each. Cape Verde (BDVDCV) and Sierra Leone both have 4 and 1 company(s) listed on their stock market.

2.3. West African stock market capitalization

Table 2 also depicts the market capitalization of 4 of the stock markets in the ECOWAS region, with the exception of that of Sierra Leone due to the unavailability of the data. It can be seen that the Nigerian stock market is obviously the biggest market in the region with a market capitalization of about 50 billion dollars and takes about 60% of the total market capitalization in the region. The second largest market by market capitalization is the Ghanaian stock market with about 20.17 billion dollars and about 24% of the regional market capitalization. The BRVM is the third largest market in the region by market capitalization with about 12.49 billion dollars and 15% of the regional market capitalization. The stock market of Cape Verde is the smallest market based on the available data with a market capitalization of 0.638 million and about 1% share of the total regional market capitalization.

Table 2. Number of listed companies and market capitalization in West African stock markets

Source: Adapted from NSE (2014).

Stock market	Number of listed companies	Market cap (billion US dollars)
NSE	171	49.97
GSE	42	20.17
BRVM	42	12.49
BDVDCV	4	0.638
Sierra Leone	1	NA

3. DATA AND METHODOLOGY

Daily stock market indices from 2008 to 2016 for the three frontier markets in the West African region and the UK and US markets were collected from various sources for the study. The stock market of Nigeria, Ghana, the WAEMU, the UK and USA are represented by Nigerian Stock Exchange-All Shares Index (NASI), Ghanaian Stock Exchange-Composite Index (GCI), BRVM-Composite Index

(BCI), Financial Times 100 Index (FTI) and Standards and Poor 500 Index (SPI), respectively. The NASI was obtained from the Nigerian Stock Exchange and the African Markets website. The GCI was obtained from Ghana Annual Report and the African Market website. The BCI was obtained from the African Market website, the FTI from the Financial Times website, while the SPI was sourced from Yahoo Finance website. The returns of the indices are represented, respectively, by the acronyms NASIR, GCIR, BCIR, FTIR and SPIR. Daily returns of the indices were calculated using the formula $x = 100 \cdot \log\left(x/x(-1)\right)$, where x stands for daily index datum of the respective indices. The indices were logged to avoid spurious results.

Correlation and Multiple Regression Ordinary Least Square (OLS) analyses were utilized to ascertain the extent and nature of the relationship between the index returns of market pairs in the study. Correlation is relevant in assessing the relationship between time series variable in the short run. The correlation technique was used to analyze the entire data for the nine years covered by the study, and yearly samples to investigated changes with time. Correlation model specification is stated in equation:

$$R = \frac{n\sum xy - \sum x \sum y}{\sqrt{\left[n\sum xi^2 - \left(\sum xi\right)^2\right]\left[n\sum yi^2 - \left(\sum yi\right)^2\right]}}, \quad (1)$$

where x and y represent index or index returns data point of the various stock markets in pairs, which could be the combination of any of the stock indices of Nigeria, Ghana, WAEMU, USA or the UK. Laerd Statistics (2018) provides evidence that correlation value R ranges from –1 to 1. Negative or positive correlation values between 0.5 to 1.0 are considered as strong, 0.3 to 0.5 as moderate, 0.1 to 0.3 as weak and less than 0.1 as very weak.

For the OLS regression analysis, five models are specified with each of the markets in the study serving as the dependent variable in the respective models, while the other markets serve as independent variables, respectively. The model is specified as follows:

$$Yi = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + ui. \quad (2)$$

4. EMPIRICAL ANALYSIS

4.1. Descriptive statistics

The descriptive statistics give a preliminary view of the data for the study, as seen in Table 3. The mean of the index returns reveals that the GSE has the highest returns in the sample period followed by the SP500, BRVM, FTSE100 and lastly the NSE. From the maximum statistics, the NSE has the maximum returns for the sample period followed by SP500, FTSE100, GSE and BRVM. Similarly, the minimum returns in the sample period was from the NSE also followed by the SP500, FTSE100, the GSE and the BRVM. The standard deviation indicates that the SP500 exhibited higher levels of returns volatility in the sample period followed by the FTSE100, NSE, BRVM and the GSE.

Descriptive statistics for the yearly returns are also calculated from which average yearly returns are computed, for the selected markets (see Table 4). The yearly index mean returns show that the markets in the West African region had higher positive returns than their global counterparts, as indicated in the NASIR in the years 2011 and 2012, GCIR in the year 2008, 2010 and 2013 and the BCIR in the years 2013, respectively. These were all more than 10% and could be an attraction for foreign investors. Generally, the other returns across the five markets in the study were either positive and less than 10% or negative.

Table 3. Descriptive statistics for equity market index returns for 2008–2016

Source: Authors' computation (2019).

Descriptive statistics	NASIR	GCIR	BCIR	FTIR	SPIR
Mean	–0.0329	0.0270	0.0160	0.0045	0.0186
Maximum	11.7583	5.1426	6.2301	9.3843	10.9572
Minimum	–9.4753	–8.7540	–5.9997	–9.2655	–9.4695
Std. dev.	1.1646	0.7245	0.8124	1.2679	1.3260

http://dx.doi.org/10.21511/imfi.16(3).2019.12

Table 4. Yearly equity market index mean returns

Source: Authors' computation (2019).

Year	NASIR	GCIR	BCIR	FTIR	SPIR
2008	–0.2430	0.1790	–0.0456	–0.1444	–0.1921
2009	–0.1597	–0.2430	–0.1161	0.0663	0.0696
2010	0.0667	0.1080	0.0652	0.0270	0.0403
2011	–0.0679	–0.0121	–0.0530	–0.0220	–0.0043
2012	0.1159	0.0821	0.0675	0.0218	0.0484
2013	0.1487	0.2235	0.1274	0.0519	0.0997
2014	–0.0677	0.0202	0.0409	–0.0105	0.0415
2015	–0.0733	–0.0481	0.0629	–0.0194	–0.0028
2016	–0.0258	–0.0640	–0.0152	0.0518	0.0350

4.2. Correlation analysis

Firstly, correlation is conducted between the indices of the five markets selected for the study for the entire sample period, as seen in Table 3. Secondly, the data are segmented to yearly sub-periods to examine the nature of variation in the yearly correlation of returns.

4.2.1. Pairwise index returns correlation for the entire sample period (2008–2016)

The correlation result between the NASIR and the GCIR for the entire sample period (i.e. 2008–2016) shows a positive but low correlation between the return of the two markets (0.022845). Between the NASIR and the BCIR, the correlation is also positive and low (0.021741). Between the NASIR and the FTIR, the correlation value is also low and positive, but higher than the correlation of NASIR with the GCIR and BCIR in the West African region. The lowest correlation value of the NASIR is with the SPIR (0.018921) and was positive.

The correlation between the GCIR and BCIR (0.037228) is positive and low, but higher the correlation between the NASIR and the two former. The correlation between the GCIR and the FTIR is negative and low (–0.015235). Similarly, the correlation between the GCIR and the SPIR is negative and low (–0.027949). The correlation between the BCIR and the FTIR is negative and very low (–0.002904), so also is the correlation between the BCIR and the SPIR (–0.004357). Finally, the highest level of correlation is observed between the SPIR and the FTIR (0.581886). The low correlation coefficient observed from the results gives credence to the absence of multicollinearity and thus spurious results (see Table 5).

4.2.2. Yearly correlation analysis of index returns

The yearly correlation is further analyzed in order to examine the nature of the correlation between the market indices in yearly sub-periods over the 9 years sample period of the study, throwing light on the evolution of correlation of the market index returns over time, as shown in Tables 6a and 6b. The yearly correlation of returns between the NASIR and GCIR started with a low positive coefficient in 2008, became negative in 2009, 2011, 2012 and 2013, but has become positive and higher in 2015 (0.131248) and 2016 (0.107611) than the positive correlation coefficient at the beginning of the sample period. Between the NASIR and the BCIR returns, the coefficient of correlation was low and negative (–0.59901) in 2008, 2009 and 2011, was positive in 2010 and ended up in 2016 with a

Table 5. Correlation output for the entire sample period (2008–2016)

Source: Authors' computation (2019).

Variables	NASIR	GCIR	BCIR	FTIR	SPIR
NASIR	1.0000	0.0228	0.0217	0.0597	0.0189
GCIR	0.0228	1.0000	0.0372	–0.0152	–0.0279
BCIR	0.0217	0.0372	1.0000	–0.0029	–0.0043
FTIR	0.0597	–0.0152	–0.0029	1.0000	0.5819
SPIR	0.0189	–0.0279	–0.0043	0.5819	1.0000

Table 6a. Yearly pairwise correlation

Source: Authors' computation (2019).

Year	NASIR/GCIR	NASIR/BCIR	NASIR/FTIR	NASIR/SPIR	GCIR/BCIR
2008	0.0272	–0.0599	–0.0396	–0.0435	0.0294
2009	–0.0185	–0.0675	0.1721	0.0891	–0.0612
2010	0.0404	0.0612	0.0608	0.0310	0.0779
2011	–0.0008	–0.1126	0.0773	0.0322	0.0301
2012	–0.0998	0.0230	0.0773	0.0322	0.0301
2013	–0.0575	0.1234	0.1823	0.0400	0.0234
2014	0.0062	0.1000	0.1024	0.0197	0.0745
2015	0.1312	0.1280	0.0509	–0.0796	0.1188
2016	0.1076	0.0123	0.0134	0.0515	–0.0425

Table 6b. Yearly pairwise correlation

Source: Authors' computation (2019).

Year	GCIR/FTIR	GCIR/SPIR	BCIR/FTIR	BCIR/SPIR	FTIR/SPIR
2008	–0.0041	0.0112	0.0056	0.0278	0.5120
2009	0.0564	0.0053	–0.0251	–0.0993	0.6439
2010	–0.1681	–0.1552	–0.0052	0.0140	0.6683
2011	–0.0783	–0.0730	–0.0317	0.0032	0.6963
2012	0.0386	0.0032	–0.0165	–0.1065	0.6405
2013	0.0624	0.0194	0.0454	0.0263	0.5456
2014	0.0667	0.0197	0.0021	0.0055	0.4977
2015	–0.0777	–0.1248	0.0271	–0.0217	0.5387
2016	0.0301	0.0244	–0.0359	0.0629	0.6128

positive sign. Between the NASIR and the FTIR returns, the coefficient was low and negative in 2008, with its highest value in 2013 (0.182259) it ended in 2016 with a positive value of 0.13461. Between the NASIR and the SPIR returns, the correlation coefficient was also low and negative in 2008 and its highest correlation value is observed in 2009 while ending with a positive coefficient in 2016.

The correlation between the GCIR and the BCIR started with a low positive coefficient in 2008 followed by a negative coefficient in 2009. The highest correlation value was in 2015 (0.118825) while ending with a negative correlation in 2016. The coefficient between the GCIR and the FTIR indicates a very low negative correlation in 2008 followed by a positive value of 0.05684 in 2009. The coefficient was 0.66732 in 2014 and –0.077705 in 2015, ending with a low positive value (0.030169) in 2016. The correlation between the GCIR and the SPIR returns starts with a low positive correlation value of 0.011996 in 2008, with its highest negative values in 2010 (–0.155227) and 2015 (–0.124825) and ends with a low positive value of 0.024478 (see Table 6b).

Between the BCIR and FTI returns, the correlation coefficient starts with a very low positive value (0.005618). The coefficient was negative and low from 2009 to 2012, with its highest value (0.045489) in 2013, while ending with a low negative (–0.035864) coefficient in 2016. Between the BCIR and the SPIR returns, the correlation coefficient was low and positive in 2008, went negative in 2009, hit its highest negative value (–0.106552) in 2012 and ended with a positive value (0.062884) in 2016. Lastly, between the FTIR and the SPIR returns, the correlation coefficient starts with a positive and relatively high value (0.511958) and remained positive through the study period with its lowest value in 2014 (0.497697) and its highest value in 2011 (0.696343) and ending in 2016 with a value of 0.612760. In general, the correlations between the two global index returns were higher than the other pairs in the study (see Table 6b).

4.3. Multiple regression analysis

The unit root test is performed to ascertain if the variables are stationary. The Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests for unit roots are utilized. The results indicate that the returns of all the market indices were stationary at the level, which gives a justification to carry out the OLS analysis (see Table 7).

http://dx.doi.org/10.21511/imfi.16(3).2019.12

Table 7. Unit root test

Source: Authors' computation (2019).

Variable	Level ADF test	Level PP test
BCIR	0.0001	0.0001
GCIR	0.0000	0.0001
NASIR	0.0000	0.0000
SPIR	0.0000	0.0001
FTIR	0.0000	0.0000

In the first regression model, the NASIR is the dependent variable, while the returns of the other markets (thus, GCIR, BCIR, FTIR AND SPIR) are the independent variables. The results indicate that only the FTIR had a significant (positive) relationship with the NASIR at the 1% level of significance. Furthermore, while the GCIR and the BCIR had an insignificant positive impact on the NASIR, the SPIR had a negatively insignificant effect on the NASIR. This implies that the UK stock market positively and significantly influences the Nigerian stock market (see Table 8).

Table 8. Regression result with NASIR as the dependent variable

Source: Authors' computation (2019).

Regressors	GCIR	BCIR	FTIR	SPIR
Coefficient	0.036224	0.030124	0.067572	–0.020343
P-value	0.2748	0.3083	0.0037	0.3609

In the second model, the GCIR is the dependent variable, while the other market returns are the independent variables. The results indicate that only the BCIR has a statistically significant (positive) relationship with the GCIR at the 10% level of significance. Meanwhile, the NASIR indicates a positive but insignificant relationship, while the FTIR and SPIR were both negatively and insignificantly related to the GCIR. This implies that the BRVM has weak, but positive and significant impact on the Ghana stock market, while the other markets do not significantly impact the latter (see Table 9).

Table 9. Regression result with GCIR as the dependent variable

Source: Authors' computation (2019).

Regressors	NASIR	BCIR	FTIR	SPIR
Coefficient	0.0140	0.0326	–0.0000	–0.0154
P-value	0.2748	0.0762	0.9973	0.2671

In the third model with the BRVMRTURNS as the dependent variable, only the GCIR indicated a significant (positive) relationship with the former at the 10% level of significance. While the NASIR was insignificant but positive, the FTIR and SPIR were negative. Thus, the BRVM and the Ghanaian stock market both have a weak but significant impact on each other (see Table 10).

Table 10. Regression result with BCIR as the dependent variable

Source: Authors' computation (2019).

Regressors	GCIR	NASIR	FTIR	SPIR
Coefficient	0.0411	0.0147	–0.0014	–0.0015
P-value	0.0762	0.3083	0.9321	0.9225

In the fourth model, the FTIR is the independent variable, while the returns of the other markets serve as the independent variables. The results indicate that the variations in the FTIR are significantly positively influenced at the 1% level by the NASIR and the SPIR with a greater impact from the SPIR. The impacts of the other markets are both negative and insignificant. The implication, therefore, is that the Nigeria and US equity markets impact the UK market (see Table 11).

Table 11. Regression result with FTIR as the dependent variable

Source: Authors' computation (2019).

Regressors	BCIR	GCIR	NASIR	SPIR
Coefficient	–0.0022	–0.0001	0.0530	0.5555
P-value	0.9321	0.9973	0.0037	0.0000

Finally, in the fifth and final model with the SPIR as the dependent variable, the SPIR is positively and significantly impacted by the FTIR only at the 1% level of significance. The results also indicate a negative and insignificant relationship between the SPIR and the other markets in the study. This implies that the US stock market has closer ties with the UK market in comparison with the West African stock markets (see Table 12).

Table 12. Regression result with SPIR as the dependent variable

Source: Authors' computation (2019).

Regressors	FTIR	BCIR	GCIR	NASIR
Coefficient	0.6092	–0.0027	–0.0341	–0.0175
P-value	0.0000	0.9225	0.2671	0.3609

5. IMPLICATIONS OF FINDINGS AND RECOMMENDATIONS

From the correlation analysis of the entire sample period in this study, the highest correlation value is between the US and UK markets returns, indicating a strong relationship, followed by the Nigerian and UK returns and the other market pairs, which are all very weak. Obadiaru et al. (2018) though found significant mean and volatility spillover amongst the stock markets in the West Africa region, the difference in findings could be attributed to the difference in the analytical technique. Meanwhile, the pair with the least absolute correlation value is the UK and the WAEMU. Language could be a factor fostering the relationship between the US/UK and UK/Nigerian market pairs, while inhibiting the same between the UK/WAEMU, as the WAEMU is basically French-speaking made up of French-speaking countries. From the correlation analysis performed on the pairs of yearly sample, 8 (NASIR/GCIR, NASIR/BCIR, NASIR/SPIR, NASIR/FTIR, GCIR/BCIR, GCIR/SPIR, BCIR/SPIR, and FTIR/SPIR)) of the 10 pairs were more correlated (positively) at the end of the sample period in 2016 than at the beginning. This generally gives some credence to a growing level of equity market integration at the regional and global level.

The finding of a growing level of regional stock market integration is not in line with that of Agyei-Ampomah (2011), which could be attributable to the difference in the time frame considered by both studies. Meanwhile, the finding of growing integration with the global market is in line with Agyei-Ampomah (2011). The finding of this study is also in line with that of Agyapong (2014) and the view of Mobolaji and Kedir (2012) of weak integration between the stock markets in West Africa.

The implication of the regression result is generally in line with those of the correlation analysis, as it reveals that the US and UK stock markets are strongly connected, but showed a weak relationship between the Nigerian and UK market, as well as between the WAEMU and Ghanaian stock markets.

The findings have implications for diversification strategies of investors and the *dejure* integration drive of the ECOWAS. The findings indicate that opportunities to diversify still exist within the region both for regional and global investors. For regional policymakers, there is the need to foster more awareness with respect to investment opportunities that exist in the region. Besides other recommendations, the study suggests that along with the dejure integration process, efforts should be made to boost the growth of the technology sector in West Africa by creating an enabling environment for entrepreneurs with technological initiatives to thrive, thereby affording them access to funding both from the money and stock markets. Since technology-related firms have high growth potentials in this technology-driven age, the sector has the potentials to create direct jobs and high return on investment, which will, in turn, boost the growth of the stock markets in the region.

CONCLUSION

The aim of the study was to examine the extent of correlation of stock market returns amongst markets in the West African region and with the US and UK stock markets using correlation and regression analysis. The entire sample period was considered alongside the yearly subsample periods in the correlation analysis. From both the whole and subsample period analysis, the returns of the US and UK stock markets were found to be most correlated with a strong relationship, implying that diversification opportunities between both markets may be somewhat limited. The correlations between the returns of other market pairs were generally weak in the entire sample period and weak or very weak, but increasing from the yearly sub-samples implying that possible gains from portfolio diversification largely exist in the short run. The regression analysis was performed on the full sample data and largely corroborates the correlation estimates.

http://dx.doi.org/10.21511/imfi.16(3).2019.12

To this end, the study concludes that while a strong relationship exists between the two major global stock markets studied, a rather weak relationship exists between the West African equity markets. The study contributes to the extant literature on stock market integration between emerging and developed markets. Besides revealing that the simply correlation technique could portend some valid results amidst other more complicated techniques, the study throws light on the growing interdependencies of markets across developed and emerging markets. Further studies can be carried out using other techniques, larger scope and/or frequency of data.

REFERENCES

1. Aawaar, G. (2017). *African Stock Markets: Empirics of development, integration, efficiency and investor herd behaviour* (Thesis, Department of Economics). University of Zululand. Retrieved from https://docplayer.net/58889600-University-of-zululand-african-stock-markets-empirics-of-development-integration-efficiency-and-investor-herd-behaviour.html
2. Abdullahi, S. I. (2017). *Stock market linkage, financial contagion assets price movement: Evidence from Nigeria Stock Exchange* (MPRA Paper No. 83455). Retrieved from https://mpra.ub.uni-muenchen.de/83455/
3. Aggarwal, R., & Kyaw, N. A. (2005). Equity market integration in the NAFTA region: Evidence from unit root and cointegration tests. *International Review of Financial Analysis, 14*(4), 393-406. https://doi.org/10.1016/j.irfa.2004.10.008
4. Agyapong, D. (2014). Stock market integration in West African Monetary Zone: A linear and nonlinear cointegration approach. *Asian Economic and Financial Review, 4*(5), 563-587. Retrieved from https://ideas.repec.org/a/asi/aeafrj/2014p563-587.html
5. Agyei-Ampomah, S. (2011). Stock market integration in Africa. *Managerial Finance, 37*(3), 242-256. https://doi.org/10.1108/03074351111113306
6. Aregbeshola, A. R. (2016). The role of local financial market on economic growth: A sample of three African economic groupings. *African Journal of Economic and Management Studies, 7*(2), 225-240. https://doi.org/10.1108/AJEMS-06-2014-0048
7. Bartram, S. M., Taylor, S. J., & Wang, Y. H. (2007). The Euro and European financial market dependence. *Journal of Banking & Finance, 31*(5), 1461-1481. http://dx.doi.org/10.2139/ssrn.673641
8. Berben, R., & Jansen, W. J. (2005). Comovement in international equity markets: A sectoral view. *Journal of International Money and Finance, 24*(5), 832-857. https://doi.org/10.1016/j.jimonfin.2005.04.001
9. Bundoo, S. K. (2017). Stock market development and integration in SADC (Southern African Development Community). *Review of Development Finance, 7*(1), 64-72. https://doi.org/10.1016/j.rdf.2017.01.005
10. Celik, S., & Baydan, E. (2015). Bringing a new perspective on Co-Movements of stock markets in emerging economies through causality and wavelet analysis. *Topics in Middle Eastern and African Economies, 17*(1). Retrieved from https://ecommons.luc.edu/meea/206/
11. Donadelli, M. (2014). The behaviour of international stock market excess returns in an increasingly integrated world. In *Emerging Markets and the Global Economy* (pp. 725-748). Academic Press. http://dx.doi.org/10.1016/B978-0-12-411549-1.00030-2
12. Ehrmann, M., Fratzscher, M., & Rigobon, R. (2011). Stocks, bonds, money markets and exchange rates: measuring international financial transmission. *Journal of Applied Econometrics, 26*(6), 948-974. Retrieved from https://www.nber.org/papers/w11166
13. Eun, C. S., & Shim, S. (1989). International transmission of stock market movements. *Journal of Financial and Quantitative Analysis, 24*(2), 241-256. https://doi.org/10.2307/2330774
14. Forbes, K. J., & Chinn, M. D. (2004). A decomposition of global linkages in financial markets over time. *Review of economics and statistics, 86*(3), 705-722. https://doi.org/10.3386/w9555
15. Gail, N., & Kapingura F.M. (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. https://doi.org/10.19030/iber.v14i2.9169
16. Gour'ene, A. G. Z., & Mendy, P. (2014). *African stock market integration? A wavelet Analysis*. Retrieved from https://mpra.ub.uni-muenchen.de/76048/
17. Laerd Statistics (2018). *Pearson product-moment correlation*. Retrieved from https://statistics.laerd.com/statistical-guides/pearson-correlation-coefficient-statistical-guide.php
18. Liu, C. (2009). *Regional integration of stock markets in Asia Pacific countries* (Thesis Submitted to Leonard N. Stern School of Business). New York University. Retrieved from https://pdfs.semanticscholar.org/a5d2/c86229932b35f6477c8016d20ec7a0618172.pdf

19. Lucey, B., & Voronkova, S. (2005). *Linkages and relationships between emerging European and developed stock markets before and after the Russian crisis of 1997–1998* (Discussion Paper No. 54). Institute for International Integration Studies. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=625581

20. Maggiora, D. D., & Skerman R. (2009). *Johansen cointegration analysis of American and European Stock Market indices* (Master Thesis). School of Economics and Management, Lund University. Retrieved from https://lup.lub.lu.se/student-papers/search/publication/1437434

21. Mobolaji, H. I., & Kedir, A. (2012). Financial integration and common investment market among ECOWAS Countries. *Journal West African Integration, 1*(2), 81-108. Retrieved from https://docplayer.fr/31147770-Journal-of-west-african-integration.html

22. Obadiaru, E. D., Oloyede, A. J., Omankhalen, E. A., & Eyiolorunshe, T. D. (2018). *Examining returns and volatility spillover in West Africa.* Paper presented at the *32nd International Business Information Management Conference*, Spain.

23. Osaze, E. B. (2007). *Capital Markets: African and Global.* Bookhouse Company, Nigeria.

24. Sahar, N., & Shah, S. Z. A. (2017). Stock market return and volatility spillovers: The case of selected Muslim majority countries. *Journal of Islamic Business and Management, 7*(1), 68-86. https://doi.org/10.26501/jibm/2017.0701-006

25. Syllignakis, M. N., & Kouretas, G. P. (2011). Dynamic correlation analysis of financial contagion: Evidence from the Central and Eastern European markets. *International Review of Economics & Finance, 20*(4), 717-732. https://doi.org/10.1016/j.iref.2011.01.006

26. Tan, K.Y., & Tse, B. K. (2001). *The integration of the East and South-East Asian equity markets* (Research Collection, School of Economics). Singapore Management University. Retrieved from https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=1701&context=soe_research

27. WAMA (2011). *Financial system integration in ECOWAS: Opportunities, challenges and prospects*. West Africa Monetary Agency, Freetown. *Retrieved from* http://amao-wama.org/publications/financial-system-integration-in-ecowas-opportunities-challenges-and-prospects/

http://dx.doi.org/10.21511/imfi.16(3).2019.12