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INVESTIGATING LONG-RUN CO-MOVEMENTS BETWEEN EMERGING AND DEVELOPED STOCK MARKETS

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Abstract
Stock markets are increasingly becoming more interdependent due to internationalization and the ever increasing level of financial globalization. The aim of the study is to empirically investigate if there is a long-run relationship between the Nigerian Exchange Limited and some emerging and developed economies using the Johansen cointegration technique. Major market indexes were selected to represent each market. A significant long-run relationship was found between most of the markets in the West African region and their global counterpart. Meanwhile an insignificant long-run relationship was found among the West African stock markets. The findings imply that diversification opportunities exist more amongst equity markets in the West African region than with major global equity markets. The study recommends that the formal stock market integration process should be fostered while more efforts should be made to make the markets more resilient against negative global equity flows.

Keywords: Johansen cointegration, Stock Markets, emerging markets, developed markets, Long-run relationship.

JEL Classification: G15, C32

1. Introduction

Stock markets are integral institutions in most developed and developing economies alike. Due to the internationalization of the markets and ever-increasing level of financial globalization, stock markets have been found to be interdependent. Another factor that has been alluded to foster interdependences between financial markets is *dejure integration* which connotes formal, legal or governmental arrangements to foster cooperation and closer interactions between markets in this regard. *Dejure* integration along regional lines have been on the increase in functional areas like trade and finance. In the West African region, concerted effort towards capital market integration has been heightened.

Wakeman-Linn and Wagh (2011) posited that empirical research in Sub Saharan Africa on Regional Financial Integration (RFI) is relatively rare, thus eliciting the need for this study. Studies of Agyapong (2014), Mobolaji and Kedir (2012), Agyei-Ampomah (2011) and the West African Monetary Agency (WAMA 2011) are among the few recent empirical studies on regional financial integration in West Africa with the aim of examining the level of financial market integration in the region. Alagidede's (2008) study covered both African, other emerging and developed stock markets, but considered only Nigeria from West Africa. These studies are all limited in their longitudinal scope as they do not cover periods of the implementation of West African Capital market integration (WACMI). Other empirical studies outside the region that have been focused on the determinants of regional integration, as well as the extent and impact of integration, include those of Mobarek (2012) and Khositkulporn (2013). Empirical studies on stock market integration in the African continent have been focused more on North, East and Southern Africa. Considering the implementation of the first phase of the Capital Market Integration process in the region, attempts towards the initiation of the second phase, and the general perception of an increase in global and regional financial integration, this study is hence apt.

The study spans a period of nine years from 2008 to 2016, covering the three largest capital markets in the Economic Community of West African States (ECOWAS) region which are the Nigerian Exchange Limited (NGX), the Ghanaian Stock Exchange (GSE), and the Bourse Régionale des Valeurs Mobiliéres (BRVM), and also the US and UK markets. The stock markets of Nigeria, Ghana and the WAEMU were selected due to their size and level of activity, as the other two markets in the region are very small and thus negligible. The US and UK markets were selected to represent the global stock market as the US market is the biggest globally, while the UK market is one of the biggest markets with the UK being recognised as a major global financial centre. The US was also selected as it has strong trade relationships with the West

African countries as well as the UK. The US has also been at the forefront of globalization thus with potentials to affect other countries across the world including West African countries. The UK, on the other hand, colonized both Nigeria and Ghana thus influencing the lingua Franca of the two latter countries. More so the UK tends to maintain some form of cordial relationship with their erstwhile colonies.

The time scope of the study was selected because it sufficiently covers both the periods not examined by most of the previous studies, the global financial crisis period and the periods of both low and more concerted efforts geared towards higher levels of cooperation and integration between stock markets in the ECOWAS region. Importantly, the scope sufficiently covers the period in which the first phase of the WACMI also known as the sponsored Access phase was implemented. The study focuses on the integration of the equity segments of the capital market due to the dynamic nature of the segment.

2. Review of Empirical Literature

Alagidede (2008) studied the integration of stock markets in Africa within themselves, and with other emerging and developed markets from 1997 to 2006. The selected African markets include South Africa, Egypt, Nigeria, and Kenya. The selected emerging countries were India, Brazil and Mexico; while the US, UK and Japan were selected to represent the developed countries. Johansen cointegration, correlation and Granger causality with Impulse Response Function (IRF) were utilized. The study showed that there were weak interactions between African markets. It further showed that concerning the developed markets, only South Africa and Egypt showed a significant relationship. Finally, with the exemption of South Africa, the other African markets did not show a significant relationship with other emerging markets outside Africa.

Heilmann (2010) studied the long and short-run relationship amongst the equity markets of the US and those of Japan, Hong Kong, Korea, Thailand, Singapore, Malaysia, Taiwan and the Philipines using 817 weekly stock index prices from 1995 to 2010. The vector error correction model (VECM) indicated a significant long and short-run relationship between the US and the Asian markets, with the Korean market being dominant.

Anaraki (2010) investigated how the US financial crises and Fed policies influenced the European stock market. Monthly data from January 1999 to April 2009 were analysed using Johansen and Julius cointegration, Granger causality test and the VECM. The US Fed policy was captured using their money market rates, federal fund rates, and

industrial sector production, while the NASDAQ and Dow Jones stock market indices were employed to capture the US financial crises. From the findings of the study, one cointegrating vector was found, while the results also suggest that both markets are cointegrated. The Granger causality test showed a unidirectional causal effect stemming from the US to the European market. Meanwhile, the variance decomposition analysis indicated that the Dow Jones index had the highest impact on the European stock market.

Khan (2011) examined the cointegration of the US stock market with that of 22 other developed and developing countries. The Johansen and the Gregory and Hansen cointegration approaches were used to analyse daily index data from 1999 to 2010. While the Johansen cointegration failed to find the existence of a long-run relationship in most of the cases between the US market and the other markets, the Gregory and Hansen test found cointegration in most of the cases.

WAMA (2011) conducted a study on financial integration in West Africa. For the integration of capital markets, the relationship between the BRVM, the N and the GSE were examined using quarterly index data from the first quarter of the year 2000 to the third quarter of 2010. Vector autoregressive (VAR) method 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. Though the study was West African wide, it did not assess if a causal relationship or volatility spillovers exist between and among the stock markets.

Mobolaji and Kedir (2012) conducted an empirical study on Financial Integration (FI) and Common Investment Market in ECOWAS. Investment data was used as a proxy for Common Investment Market to assess the impact of FI on it, as the common investment market which is a product of the *dejure* integration was not in existence by then. A linear panel one-way error component model was used. IM (investment Market) was used as the dependent variable, while GDP, financial development, financial integration indicators (with dummy variables used as proxies), institutional policy (measured by a proxy), trade openness financial, monetary policy fiscal policy served as the independent variables. The data spanned the period from 1980 to 2006. The results suggest that the openness of trade and finance have positive impacts on the investment environment of the region. The FI indicator did not perform well in the model, either suggesting that the variable did not adequately capture the impact of financial integration in the region, or that the impact of FI is not visible due to the low level of integration in the region.

Yabara (2012) examined capital market integration in East Africa Community from November 2003 to December 2010 with a focus on the three major markets in the region (that is, the stock markets of Keyan, Uganda, and Tanzania). The study was focused on testing for Beta and Sigma convergence, and cointegration. Results from the beta suggested fast convergence in the stock markets. While the sigma convergence results suggest that there was stagnation in the interaction of the markets in the past few years. The result from the cointegration analysis indicated that there is no long-run relationship between the markets 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 a weak sign of integration between the Ghanaian and the Nigerian stock markets, while the non-linear method indicated that both markets were not integrated. This study did not cover the BRVM as such WAEMU, thus its focus was on WAMZ rather than ECOWAS. Also, the study did not include markets in the international or global investment space outside of the region besides being limited in longitudinal scope.

Hussain and Saeed (2016) examined the cointegration of stock returns between Asian countries from 1996 to 2014 using both bivariate and multivariate models. The entire sample period was divided into five sub-sample periods in other to capture the nature of variation with the different periods which were grouped to distinguish periods of crises from periods of calm in the financial market.

Aawaar (2017) studied the US stock market and twelve stock markets in Africa including the Nigerian, Ghanaian stock exchange and the BRVM to examine their integration, development, efficiency and herding behaviour using GARCH, wavelets analysis, GMM technique and Cross-Sectional Absolute Deviation (CSAD) modelling technique from a regional and global perspective from 2000-2014. Findings from the study revealed that the comovement and integration of African stock markets with the global stock market are both time-varying and scale-dependent and vary among market pairs. While significant comovement with the global market was observed, weak intra and inter-regional comovement were observed among the African markets. The study concludes that informational efficiency was associated with the integration of stock markets.

Polanco-Martinez, Fern´andez-Macho, Numann and Faria (2018) investigated the integration between five stock markets in European countries (Italy, Spain, Ireland, Greece, and Portugal) among themselves and with the S&P Europe 350 index in the

pre-crisis and crises period using the wavelet analysis and nonlinear Granger causality from 2004 to 2011. The results indicate higher levels of correlation in the crises period than in the period before the crises. Also, the Italian, Portuguese and Spanish markets showed higher levels of integration than the other markets and the S&P Europe 350 index. The results further show that while the Portugal market is the most susceptible, the Grecian market tends to drift away from the S&P Europe 350 index and thus less integrated. This finding on the Grecian market seems to be in line with that of Bogdanova (2015) where the former was seen to be drifting from the UK market post the global crises period at the beginning of her debt crisis period. Finally, the nonlinear causality test showed that there was more unidirectional and bidirectional causality in the crises period than in the preceding period.

Abdullahi (2017) studied the integration of the Nigerian stock market with nine other national stock markets including Germany, France, South Africa, China, India, Mexico, Indonesia, Turkey, and Brazil. Data included month-end prices from 2009 to 2016 and were analysed using the Johansen, and Engel-Granger cointegration techniques and the generalised IRF. The result of the cointegration test was mixed. The Johansen approach shows a weak long-run relationship between the Nigerian stock market and the other markets in the study while the Engel-Granger method showed no evidence of cointegration. The impulse response function reveals that the Nigerian market reacts more to internal shocks than external shocks from other markets. The author did not consider the major global stock markets and also ignored other markets in the West African region.

3. Data and Methodology

Secondary data was used for the study. Daily Stock market index data representing the three major West African stock markets and two major global stock markets were used in this study. 2,348 daily index points (from 2008-2016) for the 5 markets in the study were used capturing a period of intense concerted efforts toward *dejure* equity market integration in West Africa. The *dejure* integration as occasioned by the implementation of the sponsored access phase (phase 1) which began on the 1st April 2015 with the first transactions being executed on 15 July 2015 . Daily data was utilized to be able to capture the dynamic interactions between the selected markets due to high information transfer speed, as the deployment of IT in stock trading and various modern information communication tools facilitates the speedy transfer of market information across national borders. The indexes of the various national markets are not converted to a common currency in order to capture actual co-movements between the various markets in the study which is in line with Maggiora and Skerman (2009).

Major indexes for each of the markets were selected. The NGX All Shares Index (NASI) was selected for Nigeria. The Ghanaian Stock Exchange Composite Index (GCI) was selected for Ghana. The GCI which started with a base value of 1000 index points was used to replace the Ghana Stock Exchange ASI (GSE-ASI) in 2011 and because the study spans the period in which both indices were used (i.e. 2008-2016), the GSE-ASI from 2008-2010 was converted using 1000 index point base. The BRVM Composite Index (BCI) was selected for the WAEMU.

The Standard and Poor's 500(SPI) and the FTSE100 (FTI) indices were used to represent the US and UK market respectively, being the major global financial centres. The SP500 was selected to represent the US market because it captures price movement of 505 stocks issue by 500 of the most capitalized companies in the US market comprising of stocks both on the NYSE and the NASDAQ. The FTSE100 index, on the other hand, is selected to represent the UK stock market as it captures price movement of 100 blue-chip stocks listed on the London stock exchange. The NASI data was obtained from the African Markets and Cashcraft Asset Management Ltd website; the GCI and GSE-ASI was from Annual Reports Ghana and African Markets, BCI was obtained from African Markets; SPI was obtained from yahoo finance; and the FTI from the Financial Times market data website.

Due to none synchrony of trading days both across markets in countries in the West African region and markets representing the global market, missing data was experienced. This affects the running of some analysis including GARCH with most econometrics software. The data was therefore arranged to be serial for 5 trading days a week from Monday to Friday, putting in cognisance weekends and differences in holidays. To make up for holidays and other days where there was no trading in certain markets, the datum for the day preceding the holiday is repeated for the holiday to avoid the missing data challenge experienced with some analytical techniques and softwares. This approach was also employed by Bhar and Nikolova (2007) to cater for non-synchrony of trading days in different national equity markets.

The unit root test is also conducted on the index data and their returns to test for the stationarity of the series. Johansen Cointegration technique is employed to evaluate if there is a long-run relationship between markets in the region. Johansen cointegration is preferred especially when all the variables are non-stationary at levels and stationary at first difference.

4. Results and Discussions

Unit Root Test

Table 1 Result of ADF for the Index Data

VARIABLE	LEVEL ADF TEST	FIRST DIFFERENCE	ORDER OF INTEGRATION
BCIR	0.9148	0.0000	I(1)
GCIR	0.9995	0.0000	I(1)
NASIR	0.9232	0.0000	I(1)
SPIR	0.1013	0.0000	I(1)
FTIR	0.0939	0.0000	I(1)

Source: Author's compilation using Eviews 7 (2022)

Johansen Cointegration Test
The results of the multivariate of Johansen cointegration test are presented. The unit root test as presented and discussed in 4.1 indicates that all the variables were not stationary at level, which is precondition to the Johansen cointegration test.

Johansen Cointegration Test Results
From the trace test only one cointegrating equation is identified at the 5% level of significance, indicating that one linear combination exists between the five stock market indices making them to have a long run relationship over the entire sample period of the study.

Table 2. Johansen Cointegration Results (SPI Normalized) - Trace Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.041247	146.1391	69.81889	0.0000
At most 1	0.010051	47.40652	47.85613	0.0551
At most 2	0.007753	23.72789	29.79707	0.2122
At most 3	0.002199	5.484374	15.49471	0.7554
At most 4	0.000139	0.325385	3.841466	0.5684

Source: Author's compilation using Eviews 7 (2022)

Table 3. Normalized (SP500) Cointegration Coefficient for the five Market Indexes (Standard errors in parenthesis) [t statistics in brackets]

SPI	NASI	GCI	BCI	FTI
1.000000	-0.000996	0.143687	-1.652233	-0.640771
	(0.00221)	(0.06872)	(0.61197)	(0.03890)
	[-0.4506778]	[2.090905]	[-2.699859]	[16.472262]

Source: Author's compilation using Eviews 7 (2022)

The results are normalized on the SPI and the signs will be reversed for the right interpretation. All the variables but the NASI were significant at the 5% level from the T statistics. The GCI has a negative long-run relationship with the SPI, and the result implies that 1 unit increase in the GCI, will lead to a 14.3 unit decrease in the SPI in the long run. The BCI has a significant positive long-run relationship with the SPI and the result implies that a 1 unit increase in the BCI will lead to a 165 unit increase in the SPI in the long run. The FTI has a significant positive long-run relationship with the SPI, implying that a 1 unit increase in the FTI will lead to a 64 unit increase in the SPI in the long run. The NASI though has a positive long-run effect on the SPI, but it is insignificant at the 5% level.

Table 4. Johansen Cointegration Results (FTI Normalized) Trace Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.041247	146.1391	69.81889	0.0000
At most 1	0.010051	47.40652	47.85613	0.0551
At most 2	0.007753	23.72789	29.79707	0.2122

Source: Author's compilation using Eviews 7 (2022)

Similarly, from the trace test, one cointegrating equation is identified at the 5% level of significance, indicating that one linear combination exists between the five stock market indexes, further implying the existence of a long-run relationship.

Table 5. Normalized (FTI) Cointegration Coefficient for the five Market Indexes (Standard errors in parenthesis) [t statistics in brackets]

FTI	NASI	GCI	BCI	SPI
1.000000	0.001554	-0.224242	2.578508	-1.560620
	(0.00373)	(0.11213)	(1.23956)	(0.18256)
	[O.416622]	[-1.999839]	[2.080180]	[-8.54853]

Source: Author's compilation using Eviews 7 (2022)

In this case, the FTI is normalized. From the T-statistics the NASI and the GCI are not significant at the 5% level though they both have a negative and positive long-run relationship with the FTI respectively, while the BCI and the SPI respectively have a negative and positive significant long-run relationship with the FTI. A unit increase in BCI will lead to a 257.85 unit decrease in the FTI100, and a unit increase in the SPI will lead to a 156.06 increase in the FTI100 both implying a positive long-run relationship. The GCI was significant at the 10% level.

Table 6. Johansen Cointegration Results-Trace Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.011282	30.89516	29.79707	0.0372
At most 1	0.001287	4.299420	15.49471	0.8779
At most 2	0.000546	1.279811	3.841466	0.2579

Source: Author's compilation using Eviews 7 (2022)

The trace test indicates that there is one cointegrating equation at the 5% level of significance.

Table 7. Normalized (NASI) Cointegration Coefficient for the three Regional Markets
(Standard errors in parenthesis) [t statistics in brackets]

NASI	GCI	BCI
1.000000	-4.030535	-37.28463
	(5.56943)	(51.7474)
	[-O.723688]	[-0.7205121]

Source: Author's compilation using Eviews 7 (2022)

From the T -statistics neither the GCI nor the BCI has a significant long-run relationship with the NASI. The result indicates that a unit change in the GCI will lead to a 4.03 unit change in the NASI in the long run. Also, a 1 unit change in the BCI will lead to a 37.28 unit change in the NSE in the long run.

Discussion of Findings
Firstly, the Johansen cointegration test was conducted, and in the first instance with the SPI being normalized. A significant long-run relationship is found between the US stock market and the markets of Ghana, BRVM and the UK except for the NGX In the second specification with the FTI being normalised, only the BRVM and the SPI were

found to have a significant long-run relationship with the former. In the third case which tested for cointegration amongst the markets in the West Africa region with the NSE being normalized, an insignificant long-run relationship between the NASI, the GCI and BCI is found.

The aim of cointegration is to the test for the existence of a long-run relationship between the selected market indexes. This has implication for both investors and policymakers alike. If two markets are cointegrated then diversification opportunities for long term investment might be limited as the cointegrated indexed co-move in the long run. As such investors may be constrained to diversify in the short-run (that is, if there are low level or insignificant short-run comovements). On the other hand for policymakers gearing towards macroeconomic convergence, it may be an objective achieved.

In the first case where the SPI (representing the US market) is normalized, the BCI and the FTI both had a significant positive long-run relationship with the later. This implies that though the markets may not exhibit comovements in the short run, they tend to commove in the long run and may thus be partly driven by similar factors including the activities of foreign investors. This further implies that there will be little or no diversification opportunities in the long-run as risk and return could be similar confirming the Law of one price (LOOP) and as such diversification between such markets should be focused more on deriving short term benefits. For the GCI with a negative but significant long-run relationship, implies that both the SPI and the GCI move in the opposite direction in the long run. Lastly, the NASI has an insignificant positive relationship with the SPI, in the long run, portraying the existence of possible long-run diversification benefits.

In the second case, the FTI (representing the UK market) is normalized. The NASI and the GCI both have insignificant long-run relationship thus indicating the availability of opportunities for long term diversification benefits between the market pairs. Meanwhile, the FTI is cointegrated with the BCI and the SPI, portraying similar long term trend and thus little diversification opportunities and benefits in the long run. The finding that the WAEMU market has a significant long-run relationship with both the US and UK markets is at variance with the findings of Alagidede (2008) that only the South African and Egyptian stock markets had significant relationships with the two major global stock markets. This may be due to the difference in the time scope, geographical coverage of the study and the growing importance of the activities of foreign portfolio investors in the Nigerian capital market space.

Lastly, in the model with the NASI being normalised, a positive but insignificant long-run relationship was found between the NASI with the GCI and the BCI implying that though a long-run relationship among them, it is not significant which is in line with the findings of Agyapong (2014), thus the law of one price may not hold between the West African markets in the long run and thus alternate markets can still be explored as long term diversification avenues. This finding is also partly in line with that of Gail and Kapingura (2015), and Alagidede (2008) that African stock markets are not yet fully integrated, though both of the extant empirical literature were based on an African wide perspective.

5. Conclusion and Recommendations

The study set out to examine the extent of equity market integration among stock markets in the West African region *viz a viz* two major global stock markets over a nine-year period from 2008 to 2016 covering the global crises period and post crises period. Evidence of the insignificant long-run relationship between the markets in the West African region, implies that diversification opportunities largely still exist between the regional markets. The significant long-run relationship that exists between the WAEMU, Ghanaian and UK stock market with the US market, puts a restraint on opportunities to diversify and invest with a long term strategy between the markets. Similarly, the observed significant long-run relationship between the WAEMU, US and Ghanaian (at the 10% level) with the UK market also restrains opportunities to diversify with a long term strategy between the markets. The study recommends that efforts towards the ongoing *dejure* integration should be fostered, more efforts should be made to make the markets more resilient while policies to curb negative spillovers effects between equity markets should be put in place.

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