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**Regional Financial Integration: Evidence from Stock Markets  
in the West African Monetary Zone (Wamz)**

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## **<A> Introduction**

One of the unresolved issues facing Africa in the 21<sup>st</sup> century is the difficulty to achieve regional integration, which is expected to serve as a platform for the integration of Africa. While integration efforts have focused on migration and trade (see Njinkeu, 2009 for instance), regional integration could also be achieved through increased integration of the financial sector such as the stock market. Though integration efforts were being intensified prior to 2007, the impact of the 2007 to 2009 global financial crisis and its varying impact on African countries have necessitated the application of caution towards integration (Abraham, 2009). Achieving African integration remains however, a core aim of regional organizations in Africa such as the Economic Community of West African States (ECOWAS) thus; researching into alternative approaches to achieve increased integration within the region could be useful for Africa's integration.

Most studies on regional integration have argued that financial integration increases regional integration, but they do not employ specific estimation techniques to test the validity of their claim. For instance, Twu (2005) argued for the unification of stock markets in the WAMZ, but did not employ specific econometric framework to examine the linkages of the Nigerian and Ghanaian stock exchanges: the two stock markets in the WAMZ. Likewise, Harris (2008) argued that although increased financial integration was likely to be achieved in sub Saharan Africa, it was not likely that increased regional integration of stock markets (among others), will result in the foreseeable future. Similarly, Oshikoya (2009) noted that financial and economic integration in the WAMZ would play a supportive role to the success of monetary union in the WAMZ. Not only did the study not employ specific estimation techniques to test the validity of its claim, it did not pay particular attention to stock market integration: an important aspect of financial markets in emerging Nigeria and Ghana. The present study fills these gaps by providing empirical evidence on the efficiency of stock markets in the WAMZ and on the integration of stock markets in the WAMZ as well. The study therefore seeks to answer the following questions: (1) Are stock markets in the WAMZ weakly EMH efficient?

The paper is arranged into five sections. Section one above presented the background to the study highlighting the research problem, gap from the literature and the research questions. In the next section, conceptual, empirical and theoretical issues from the literature are discussed. The research methodology is discussed in section three, while the results from the data analysis are discussed in section four. Lastly, the summary and conclusion of the study are presented in section five.

## **<B> Literature Review**

### **Conceptualization**

There is a close link between the concepts of regional and economic integration. The concept of economic integration is generally used to refer to growing economic ties among countries. On the other hand, regional integration could extend to the full range of public sector activity, such as the coordination of economic policies. Basically, Regional integration refers to the emergence of a governance level between the national and global levels within the system of world governance based on cooperative behavior and the designs of common policies and institutions by actors that traditionally belong to the national governance level and, achieving increased economic ties (which includes ties in the financial sector) would be important for achieving regional integration.

In relation to financial markets (stock market), Integration refers to a process of unifying markets and enabling convergence of risk adjusted returns on the assets of similar maturity across the markets. Note that stock market (also known as equity market) is an aspect of capital market (market for long term funds) where the shares of quoted companies are bought or sold. Advancement in technology has facilitated rapid integration of this market across the globe in recent times.

Integrating the stock markets within a sub-region, a region or in the globe is generally seen as beneficial for a variety of reasons, including their ability to attract inward portfolio investment, boost domestic savings, and improves the pricing and availability of capital for domestic investment. More importantly, stock markets are seen as enhancing the operations of the domestic financial system in general (Jefferis, 1995; Kenny and Moss, 1998).

In recent years, and coupled with the wave of globalization, there has been a shift from bank-based capital market development to a more holistic approach that aims at globalizing securities' market as well as other financial institutions with the banks. Popiel (1990) emphasized that some of the strengths that make the stock markets focal point of the shifting emphasis are their ability to mobilize long-term savings for financing entrepreneurs, encourage broader ownership of firms, and improve the efficiency of resource allocation through competitive pricing mechanism. Demirguc-kunt and Levine (1996) argued that apart from these primary benefits, globalizing stock markets will accordingly ensure efficient financial intermediation and would bring further gains to the various economies. Integrating of stock market would also bring about a shift from debt to equity financing across countries (Tella and Adesoye, 2008).

Integration of stock markets however brings about increased exposure of countries to increased vulnerability and external shocks, through contagion, which raises a number of critical problems (Kibuthu, 2005). The problems associated with this include exchange and interest rates volatility and strong capital outflows having adverse effect on sustainable growth and macroeconomic management.

The World Bank (2007) attributed the disappointing outcome in Africa's growth on the small scale of the operations of most African financial systems, but that the deficiency could be corrected through promoting regional financial integration (RFI). They identified four channels of through which RFI's contribute to growth stating that RFI: (i) provides stimulus for domestic financial reforms; (ii) increases the scale of operations and competition, thereby increasing the system's efficiency and productivity; (iii) induces foreign direct investment (FDI) inflows; and (iv) enables the African systems to grow into regional and ultimately global players in financial markets.

### **Empirical Literature**

Ogun and Adenikinju (1992) proposed the need for African Economic Research in the process of integrating African Regions. The economic wisdom for this they argued is from available statistics which suggests that of all the groups in the world, Africans trade least with each other. Though their study relates more to into integration of trade unions such as the Economic Community of West African States (ECOWAS) East African Community (EAC) and so on, they conclude that the African economy stands to gain if markets are integrated.

Rousseau and Wachtel (1999) examined the relationship between equity markets and economic growth with panel data by employing vector autoregressions that apply the generalized method of moments techniques. The panel data covered 47 countries including Cote D'Ivoire, Kenya, Morocco, Nigeria and Zimbabwe from 1980 to 1995. The study found that Stock markets can promote economic performance by 1) providing an exit mechanism to venture capitalists, 2) offering liquidity to investors that encourages international diversification and portfolio flows, 3) providing firms with access to permanent capital which can then be placed in large, indivisible projects, and 4) generating information about the quality of potential investments.

Kim and Singal (2000) investigated the effect of market opening on stock market returns, volatility, and market efficiency using selected emerging markets. The study covered 27 countries (including Nigeria and Zimbabwe). Employing nonparametric test to

the data collected as well as ARCH and GARCH models, the study found that stock returns increase immediately after market opening but fall subsequently.

Agathee (2008) tested for interdependence between the Mauritian stock market and six African equity markets, namely Botswana, Malawi, Namibia, South Africa, Zambia and Zimbabwe using weekly stock indexes from January 2000 to September 2007. Employing the Granger causality test, it was found that there was almost no lead-lag relationship except with one exception that Zimbabwe leads Mauritius. Using the Engle-Granger and Johansen tests of cointegration, it is found that there was a strong cointegrating relationship involving the Stock exchange of Mauritius and the other selected African markets. These cointegrating relationships the study concluded implied reduced benefits in terms of portfolio diversification for local and foreign investors.

### **Integration in ECOWAS, COMESA, UMA AND CEMAC**

ECOWAS countries today are weakly integrated nationally, regionally and internationally, 35years after it was established in 1975. Such argument has been put forward by Prof Bamba in the presentation on ECOWAS Regional Integration: Position of Common Investment Market. It was however stated that, on-going deliberations on how to achieve increased integration within the region. One of the suggestions on how to achieve increased integration is to organize social and economic activities on a much larger scale than as they currently exists in each of the ECOWAS countries.

The AfDB (2008) presented a report on regional financial institutions (RFIs) in three sub-regions: the Common Market for Eastern and Southern Africa (COMESA), the Arab Maghreb Union (UMA), and Central African Economic and Monetary Community (CEMAC). The review in this section relies heavily on the report and aims at highlighting the progress of regional integration those regions. For COMESA, it was reported that its long-term objective is to create a single market in financial services in support of regional integration. Though progress was made in modernizing national financial institutions, the overall conclusion from the report was that the financial integration taking place within COMESA, still had a long way to go.

For the UMA (Arab Maghreb Union comprising of Algeria, Morocco, Tunisia, Mauritania and Libya, established by a Treaty in 1989), its objective as stated in the report is to progressively establish an FTA, harmonize customs duties and regulations, and create a Common Market. The UMA was reported to envisage its financial integration on the following: the harmonization of monetary and fiscal policies, financial and legal regulations,

supervisory systems, and monetary systems (AfDB, 2008: xiv). These efforts, as stated in the report were to be complemented by the creation of a common bank (i.e. the Bank of Maghreb) for investments and trade. It was however stated that, the financial sector of the UMA had not achieved much depth as expected. The conclusion was that foreign banks were substantially present in the region, especially in Morocco and that Moroccan and Tunisian banks had further established branches in the European Union, while some Moroccan banks have presence in other African countries. Specialized banks, insurance companies, and pension funds are quite well developed in Morocco and, to a lesser extent, in Tunisia.

For CEMAC (Economic and Monetary Community for Central Africa), it was reported that its ultimate objective is the creation of a Common Market and that a series of policies and measures have been put in place to promote regional economic and financial integration among its member states. However, the financial system of CEMAC is still relatively underdeveloped, insufficiently diversified, and largely dominated by the banking sector, which holds over 85percent of the financial assets and liabilities (AfDB, 2008: xvii). It was also reported that non-bank financial sector is very small and operates almost exclusively at a national level and that the banking system is also unevenly distributed among member states, with nearly one-third of banks located in Cameroon, and another half in three other countries.

In summary, the report's overall assessment was that the progress in RFI in the three regions has been slow and needs to be accelerated through a more proactive policy stance. The reasons for the slow progress was attributed to: divergent initial macroeconomic situations and an uneven level of bank soundness across member countries; a lack of political commitment to RFI; a lack of adequate (human and financial) capacities; overambitious and ill-defined objectives and timeframes; weak regional institutions charged with managing the integration process; lack of coordination between national and regional strategies; and conflicting regional obligations due to multi-organization membership of some countries.

### **Theoretical Issues**

**It is argued that stock markets play an increasing role in financial system of developing countries; they are marked by two principal features that limit their potential to facilitate economic growth. The first is their small size in terms of market capitalization and listings and the other is their low liquidity ratios. The argument is that, these markets could become more efficient with integration.**

As reviewed in Harris (2008), there is considerable evidence that both stock markets (and banks) contribute to long-run economic growth, but an important consideration however, is the efficiency of stock markets (and banks) in terms of their operating costs and profits margins. Both types of institutions however, experience internal economies of scale at certain levels of activity and may experience external benefits of agglomeration in the sense that a concentration of banks and financial markets is mutually beneficial. The theoretical argument according to Harris (2008) is that the efficiency of stock markets (and banks), could be higher in the context of a regional financial centre than when concentrated to serve a specific countries.

### **Measuring Integration and Market Efficiency**

Integration may be loosely referred to the extent to which financial markets are connected (Kenen, 1976). Financial markets may, however, be connected both vertically (through the term structure of interest rates) and horizontally across a number of geographically distinct markets at each maturity. The dynamics of asset returns across both classes and international markets is essential for the functions of everyday financial management, from managing asset allocation and assessing risk, to calculating hedge ratios, or pricing derivative instruments. The empirical approach to modelling integration range from, but not limited to structural and time series models (Alagidede, 2008).

The degree of financial market integration can be measured along several different dimensions and there is no widespread agreement about a single correct measure (Adam *et al.*, 2001; Baele *et al.*, 2004). Walti (2006) argued that while one broad approach (the De jure approach) measures of financial market integration rely on the dating of financial market liberalisations initiated by policymakers, the other (the de facto measure) focus on the outcomes of such liberalisations such as volumes, be it stocks or flows of equity, debt or foreign direct investment, or on asset prices or returns. The second approach relies on the idea that a higher level of international financial integration will result in higher cross-border holdings (stocks) of foreign assets. Due to the data available to this study, the de factor approach would be subscribed to.

Other methods for measuring market integration are the correlation index approach, the autoregressive distributed lag approach, the Vector autoregressive approach, the Augmented Engle granger cointegration tests, error correction models, and so on. Though these methods have their strengths and weaknesses, error correction model has the

advantage of measuring the short and long run relationship connecting two or more variables in a single equation.

The weak form efficient market hypothesis offers the theoretical framework to test for market efficiency. Among the various uses of the augmented dickey fuller unit root test, it is also useful in testing weak form market efficiency. These models: error correction model and the augmented dickey fuller unit root test will be used to test the efficiency of stock market, with or without integration.

There are three forms of efficiency: Weak Form (where security prices reflect all information found in past prices and volume), Semi-Strong Form (where Security prices reflect all publicly available information), and Strong Form Efficiency (where Security prices reflect all public and private information). The weak-form efficiency is represented as

$$P_t = P_{t-1} + \text{Expected return} + \text{random error } t \text{ ----- (2.1)}$$

Where  $P_t$  is the current stock market prices and  $P_{t-1}$  is its lagged value following an AR(1) process. Since stock prices only respond to *new* information, which by definition arrives randomly, stock prices are said to follow a random walk.

**<C> Research Methodology**

Five-day weekly closing stock prices data for Nigeria and Ghana from 2007 to 2009 were used for the analysis. The choice of this period is to come out with findings that would be useful in analysing the issues of stock market efficiency and integration within the context of the recent financial crisis: a major issue that is to shape Africa’s integration in the 21<sup>st</sup> century. Ghana and Nigeria were selected because they constitute the major stock markets in the WAMZ ECOWAS sub region. The data were collected from [www.africanfinancialmarkets.com](http://www.africanfinancialmarkets.com).

The study adopted the error correction model (ECM) as applied by Nwachukwu and Egwaikhide (2007: 3). They argued that ECM is best suited for model estimation when economic variables that are individually non-stationary are cointegrated, i.e. when there is a meaningful long-run relationship between them. Also, that, the error-correction technique is appealing because of its ability to induce flexibility by combining the short-run dynamic and long-run equilibrium models in a unified system. The model is specified below:

$$\Delta NSE_t = \alpha_0 + \beta(NSE_{t-1} - n_2GSE_{t-1}) + n_1\Delta GSE_t + \xi_t \text{ ----- (3.1)}$$

Where  $\xi_t$  is the residual term and  $\Delta$  is a symbol used to denote first difference of the variables. The coefficient  $\beta$ , has an apriori expectation of a negative sign and is used to test



for long run equilibrium between the NSE and the GSE. On the other hand, the coefficient,  $n_1$ , shows the short run equilibrium connecting both variables.

From the theoretical argument in Harris (2008) that stock market efficiency increases with higher regional integration, the weak form efficient market hypothesis is used to test the efficiency of the stock markets. The model is specified in a simple random walk autoregressive one (AR,1) process:

$$NSE_t = \alpha_1 + \alpha_2 NSE_{t-1} + e_{t1} \quad (3.2)$$

$$GSE_t = \beta_0 + \beta_1 GSE_{t-1} + e_{t2} \quad (3.3)$$

Where  $NSE_{t-1}$  and  $GSE_{t-1}$ , are the previous values of the Nigerian and Ghanaian stock market prices respectively.

The study raised two hypotheses. They are specified in their null form below:

*Hypothesis One:*

Ho: stock markets in the WAMZ are not integrated

*Hypothesis Two:*

Ho: stock markets in the WAMZ are not efficient

Equation 3.1 will be used to test the first hypothesis while equations 3.2 and 3.3, will be used to test the second hypothesis

## <D> Discussions and Policy Issues

The unit root test shows that the data for the stock markets in the WAMZ (Nigeria and Ghanaian stock exchanges) were not stationary at levels. At first difference however, the data became stationary. This indicates that the stock markets in WAMZ exhibit very active and volatile trend: an expected attribute of stock markets anyways. The stationarity results at levels are shown in Appendix (ai) and (bi), while the result at first difference is shown in Appendix (aai) and (bii).

### Discussions on the Efficiency of WAMZ Stock Markets

The weak form market efficiency test showed that the Nigerian stock market was weakly efficient with the expected positive sign. The t-statistics probability value was significant at 1percent critical value. And the R-square value of 20.58percent implies that

stock prices reflect 20.58percent of all information found in past prices. And since stock prices respond to *new* information, which by definition arrives randomly, the Nigerian stock market is said s to follow a random walk.

On the other hand, the Ghanaian stock market was also found to be weakly efficient at 1percent critical value, but did not have the expected positive sign. This implies that 2.9percent (the value of the R-square) of all information found in past prices has a negative impact on the present performance of the Ghanaian stock market.

Though the effect of past information on the performance of stock markets in the WAMZ varies, the results showed that they are weakly efficient and thus, follow a random walk. Therefore, the null hypothesis is rejected while the alternative is accepted implying that stock markets in the WAMZ are weakly efficient.

### **Policy Issues on the Efficiency of WAMZ Stock Markets**

The positive impact of past information on the present performance of the Nigerian stock market and the negative impact of past information on the present performance of the Ghanaian stock market have policy implications on stock market integration in WAMZ and on financial integration in the WAMZ and ECOWAS sub region at large. One possible effect is that stock markets in the WAMZ offers different investment risk options for investors. it suggests that both the Nigerian and Ghanaian stock markets are not likely to experience simultaneous shocks rather, when one is witnessing a bearish trend due to negative shocks attributable to integration, the other will be experiencing a bullish trend attributable to the benefits of not integrating.

### **Discussions on the Integration of WAMZ Stock Markets**

Since both markets are weakly efficient, it is expected that their efficiency will increase on integration. This leads to the test of the second hypothesis: are stock markets in WAMZ integrated?

The logs of both variables (the Nigerian and Ghanaian stock exchanges) were not stationary at levels thus; the direct error correction model estimation procedure was used for estimation. An ordinary least square (OLS) equation (without differencing the variables) connecting the GSE and NSE was estimated to obtain the residual (see Appendix D). The residual was then included in the data set, lagged by one and the NSE and GSE differenced by one to correct for stationarity. The error correction result is presented in Appendix E.

Though the result suggests that stock markets in the WAMZ have a positive relationship in the short-run and are integrated as well (going by the expected negative sign of the  $RES_{t-1}$  coefficient), the t-statistics shows that the results are not significant. The conclusion to be drawn is that stock markets in the WAMZ are not integrated.

### **Policy Issues on the Integration of WAMZ Stock Markets**

The conclusion that stock markets in the WAMZ are not integrated implies that, divergent factors affect the performance of both markets in the short run and they are not likely to converge in the long run thus, investors would prefer to treat both markets as separate to seek safe haven for their investments and would not be sure on the prospects of the markets if they were integrated. Basically, it would pay investors, if the markets remained disintegrated than if they were integrated. I can therefore argue that the argument by Harris (2008) which links higher efficiency of stock markets to increased regional integration might not exactly be the case.

### **<E> Summary and Conclusion**

The Economic Community of West African States (ECOWAS) aims to establish an economic union among its members by creating a monetary union and adopting common economic, financial, social, and cultural policies. ECOWAS members that are not members of The West African Economic and Monetary Union (UEMOA) agreed to harmonize their monetary and fiscal policies with those of UEMOA, with a view to establishing a monetary union in ECOWAS and preparing the ground for a possible merger with UEMOA. To accelerate the pace of integration, Ghana and Nigeria introduced a Fast-Track Initiative in 2000 to establish a second monetary zone in the region called the West African Monetary Zone (WAMZ), among The Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone. WAMZ is meant to harmonize the macroeconomic policies of the countries so as to have a common currency in circulation, while ECOWAS expects to achieve monetary integration through the merger of UEMOA and WAMZ once WAMZ becomes a single monetary zone. In line with the objective of achieving integration in the WAMZ, this study examined the integration of stock markets in the West African Monetary Zone as well as the efficiency in the context of the weak form efficient market hypothesis. Time series data for the two stock markets within the WAMZ: the Nigerian Stock Exchange (NSE) and the Ghanaian Stock Exchange (GSE) were collected while; autoregressive (AR 1) and error correction mode were used for the analysis. For the first objective, it was found that both stock markets were

weakly integrated and that while past information were likely to have positive impact on the present performance of the Nigerian stock market, past information were likely to have a negative impact on the performance of the Ghanaian stock market. for the second objective, it was found that the WAMZ stock market were not integrated and that the distortions affecting the integration of both markets in the short run were not likely to converge in the long run thus, constraining the possibility of increased regional integration. In summary, the challenge facing Africa's Integration in the 21<sup>st</sup> century is still enormous: regional financial integration is advocated by regional sub regional organizations however, empirical evidence shows that regional financial integration though desirable, might not be easily achievable. Regulations to minimize investment risk and to strengthen institutions might be some of the policies that could enhance regional integration in Africa.

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## APPENDIX

### A: STATIONARITY TEST RESULTS

#### (ai) NSE AT LEVELS

ADF Test Statistic	0.081291	1% Critical Value*	-3.4476
		5% Critical Value	-2.8685
		10% Critical Value	-2.5704

\*MacKinnon critical values for rejection of hypothesis of a unit root.

#### Augmented Dickey-Fuller Test Equation

Dependent Variable: D(NSE)

Method: Least Squares

Date: 07/25/11 Time: 15:48

Sample(adjusted): 11/06/2007 7/03/2009

Included observations: 434 after adjusting endpoints

Variable	Coefficien	Std. Error	t-Statistic	Prob.
	t			
NSE(-1)	0.000146	0.001793	0.081291	0.9352
C	-0.001295	0.008267	-0.156591	0.8756
R-squared	0.000015	Mean dependent var	-0.000623	
Adjusted R-squared	-0.002299	S.D. dependent var	0.006483	
S.E. of regression	0.006491	Akaike info criterion	-7.232264	
Sum squared resid	0.018200	Schwarz criterion	-7.213494	
Log likelihood	1571.401	F-statistic	0.006608	
Durbin-Watson stat	1.092105	Prob(F-statistic)	0.935248	

(a) NSE AT FIRST DIFFERENCE

ADF Test Statistic	-12.73863	1% Critical Value*	-3.4476
		5% Critical Value	-2.8685
		10% Critical Value	-2.5704

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(NSE,2)

Method: Least Squares

Date: 07/25/11 Time: 15:50

Sample(adjusted): 11/07/2007 7/03/2009

Included observations: 433 after adjusting endpoints

Variable	Coefficien	Std. Error	t-Statistic	Prob.
	t			
D(NSE(-1))	-0.546551	0.042905	-12.73863	0.0000
C	-0.000353	0.000279	-1.263454	0.2071
R-squared	0.273521	Mean dependent var	-1.48E-05	
Adjusted R-squared	0.271836	S.D. dependent var	0.006783	
S.E. of regression	0.005788	Akaike info criterion	-7.461525	
Sum squared resid	0.014438	Schwarz criterion	-7.442722	
Log likelihood	1617.420	F-statistic	162.2726	
Durbin-Watson stat	2.145383	Prob(F-statistic)	0.000000	



(bi) GSE AT LEVELS

ADF Test Statistic	-0.166764	1% Critical Value*	-3.4476
		5% Critical Value	-2.8685
		10% Critical Value	-2.5704

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GSE)

Method: Least Squares

Date: 07/25/11 Time: 15:51

Sample(adjusted): 11/06/2007 7/03/2009

Included observations: 434 after adjusting endpoints

Variable	Coefficien	Std. Error	t-Statistic	Prob.
	t			
GSE(-1)	-0.000541	0.003244	-0.166764	0.8676
C	0.002059	0.012795	0.160895	0.8723
R-squared	0.000064	Mean dependent var	-7.45E-05	
Adjusted R-squared	-0.002250	S.D. dependent var	0.006144	
S.E. of regression	0.006151	Akaike info criterion	-7.339784	
Sum squared resid	0.016345	Schwarz criterion	-7.321014	
Log likelihood	1594.733	F-statistic	0.027810	
Durbin-Watson stat	2.339534	Prob(F-statistic)	0.867634	

(bii) GSE AT FIRST DIFFERENCE

ADF Test Statistic	-24.65698	1% Critical Value*	-3.4476
		5% Critical Value	-2.8685
		10% Critical Value	-2.5704

\*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GSE,2)

Method: Least Squares

Date: 07/25/11 Time: 15:51

Sample(adjusted): 11/07/2007 7/03/2009

Included observations: 433 after adjusting endpoints

Variable	Coefficien t	Std. Error	t-Statistic	Prob.
D(GSE(-1))	-1.170327	0.047464	-24.65698	0.0000
C	-8.79E-05	0.000292	-0.301335	0.7633
R-squared	0.585165	Mean dependent var	-4.69E-07	
Adjusted R-squared	0.584202	S.D. dependent var	0.009411	
S.E. of regression	0.006068	Akaike info criterion	-7.366837	
Sum squared resid	0.015872	Schwarz criterion	-7.348035	
Log likelihood	1596.920	F-statistic	607.9669	
Durbin-Watson stat	1.999362	Prob(F-statistic)	0.000000	

C. STOCK MARKET EFFICIENCY RESULT

(ci) WEAK EMH (NIGERIA)

Dependent Variable: NSE

Method: Least Squares

Date: 07/25/11 Time: 16:11

Sample(adjusted): 11/07/2007 7/03/2009

Included observations: 433 after adjusting endpoints

Variable	Coefficien	Std. Error	t-Statistic	Prob.
	t			
C	-0.000353	0.000279	-1.263436	0.2071
NSE(-1)	0.453448	0.042905	10.56863	0.0000
R-squared	0.205817	Mean dependent var	-0.000634	
Adjusted R-squared	0.203974	S.D. dependent var	0.006487	
S.E. of regression	0.005788	Akaike info criterion	-7.461522	
Sum squared resid	0.014438	Schwarz criterion	-7.442719	
Log likelihood	1617.419	F-statistic	111.6958	
Durbin-Watson stat	2.145387	Prob(F-statistic)	0.000000	

(cii) WEAK EMH (GHANA)

Dependent Variable: GSE

Method: Least Squares

Date: 07/25/11 Time: 16:13

Sample(adjusted): 11/07/2007 7/03/2009

Included observations: 433 after adjusting endpoints

Variable	Coefficien	Std. Error	t-Statistic	Prob.
	t			
C	-8.79E-05	0.000292	-0.301414	0.7632
GSE(-1)	-0.170326	0.047464	-3.588498	0.0004
R-squared	0.029011	Mean dependent var	-7.52E-05	
Adjusted R-squared	0.026758	S.D. dependent var	0.006151	
S.E. of regression	0.006068	Akaike info criterion	-7.366838	
Sum squared resid	0.015872	Schwarz criterion	-7.348036	
Log likelihood	1596.920	F-statistic	12.87732	
Durbin-Watson stat	1.999362	Prob(F-statistic)	0.000371	

D. OLS RESULT CONNECTING GSE TO NSE TO OBTAIN RESIDUAL

Dependent Variable: NSE

Method: Least Squares

Date: 07/25/11 Time: 15:46

Sample: 11/05/2007 7/03/2009

Included observations: 435

Variable	Coefficien t	Std. Error	t-Statistic	Prob.
C	6.337023	0.350476	18.08120	0.0000
GSE	-0.438372	0.088865	-4.933036	0.0000
R-squared	0.053210	Mean dependent var	4.608578	
Adjusted R-squared	0.051024	S.D. dependent var	0.174023	
S.E. of regression	0.169525	Akaike info criterion	-0.707042	
Sum squared resid	12.44391	Schwarz criterion	-0.688305	
Log likelihood	155.7817	F-statistic	24.33484	
Durbin-Watson stat	0.001728	Prob(F-statistic)	0.000001	

E. ERROR CORRECTION MODEL RESULT

Dependent Variable: D(NSE)

Method: Least Squares

Date: 07/25/11 Time: 15:47

Sample(adjusted): 11/06/2007 7/03/2009

Included observations: 434 after adjusting endpoints

Variable	Coefficien	Std. Error	t-Statistic	Prob.
	t			
C	-0.000622	0.000312	-1.993790	0.0468
RES(-1)	-0.001518	0.001892	-0.802318	0.4228
D(GSE)	0.007579	0.052042	0.145624	0.8843
R-squared	0.001493	Mean dependent var	-0.000623	
Adjusted R-squared	-0.003140	S.D. dependent var	0.006483	
S.E. of regression	0.006494	Akaike info criterion	-7.229135	
Sum squared resid	0.018173	Schwarz criterion	-7.200980	
Log likelihood	1571.722	F-statistic	0.322308	
Durbin-Watson stat	1.092696	Prob(F-statistic)	0.724649	