**Nigerian Economic Growth and its Stock Market:**

 ***Does Volatility matter?***

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**Abstract**

*The study provides an extension to the a-priori relationship between growth and market development by including market volatility and volatility uncertainty into the model. The extended model takes the form of ADRL framework and it is estimated over a period of 1985 to 2012 using time series data on GDP and market capitalization index which are sourced from the Nigerian Central Bank statistical bulletin. We particularly adopt the bound test or ADRL approach to co integration and find that there is presence of long-run relationship between growth, market performance, market volatility and volatility uncertainty. Also, the results of VEC Granger Causality reveal that both market performance and market volatility lead economic growth in Nigeria and they provide positive impact on growth. However, volatility uncertainty deceases with a rise in growth rate.*

Keywords: Bound, ADRL, VEC, Granger, Causality, Co integration, Growth Volatility, Stock market, Nigeria

Jel Code: C5; C8; E2; G1; G2

* 1. **Introduction**

The perspective of growth in Nigeria is over centered on the acquisition of consumables, liabilities andnon-interest earning household assets. Therefore, the proportion of aggregate income that would have been channeled into savings or capital accumulation had been drastically shrunk overtime. The consequence of this reaction is that the stock market is left with very little savings to mobilize and canalize into productive investments. The consumption prone spending culture of an average Nigerian and the wasteful habit of the governments do not only limit the volume of transactions in the market also increase the incidence of incessant thin trading. All of these put together give rise to heteroskadastic volatility.

However, the empirical investigation on the relationship between growth and stock market development can be traced to the works of (McKinnon, 1973) and (Shaw, 1973) who critically affirmed that financial sector liberalization induces veritable avenues for large capital accumulations that invariably boost economic growth. Greenwood and Smith (1997) stressed that the pooling of resources by stock market to finance large investments increase the tempo of growth. Efficient mobilization of resources on a long-time horizon stimulates investment opportunities and spurs economic growth. Evidence has shown that the stock market is a catalyst of growth and efficiency of an economy through mobilization and allocation of scarce savings among competing ends (Alile, 1984). In a recent time, Adampoulos (2010) examined the direction of causality between growth and stock market development in Zambia and concluded that there is presence of unidirectional causality between the variables with the direction of flows trickling from stock market development. On the contrary, the study of (Sililo, 2010) is consistent with the demand following hypothesis that growth Granger causes market development in Zambia. However, the findings of (Athanasios & Antonios, 2012) in Greece refute the position of (Sililo, 2010) and overwhelmingly support the Adampoulos’ (2010) conclusion. Hence, there is a critical issue awaiting fresh contribution especially in emerging economies; can we refute the conclusion of Sililo or that of Adampoulos here in Nigeria?

Thus, this underlying critical question has issued a serious concern to us. Also, we are motivated by the possibility of investigating the missing gap as a result of the egregious shortcomings of these studies which fail to examine whether stock market volatility and volatility uncertainty could influence/cause growth. In essence, the objective of this study is to examine the relationships among economic growth, stock market performance, stock volatility and volatility uncertainty. This unequivocally extends the current issues on the relationship between growth and capital market developments. The rests of the paper are organized as follows: literature review, data and methodology, results, conclusion and recommendations

**2. Literature Review**

Various empirical studies had been conducted on the relationship between stock market development and economic growth with different positions. In the early works of (McKinnon, 1973) and (Shaw, 1973) on the financial repression which is often referred to as the “McKinnon-Shaw” hypothesis assert that the liberalization of the financial sector in the form of an appropriate rate of return on real cash balances catalyzes economic growth. The ultimate contention of this hypothesis is that savings are discouraged by a low or negative real interest rate. Consequence upon this is lowering of the available funds for investors to loan and corresponding reduction of the rate of economic growth. Therefore the model of McKinnon and Shaw overstresses that a liberalized financial system with absence of financial repression propels saving and investment to different magnitudes and consequently promotes economic growth. Pagano (1993) outlined three areas whereby financial sector development could influence growth based on endogenous growth model: one, it could increase investment outputs to a considerable height, two, it could minimize transaction costs and hence increase the proportions of savings canalized into productive investments and three, it could either promote or decline savings through concessionary rates or otherwise. However, various models emphasize that well-functioning financial markets reduce/completely eliminate information and transactions costs through efficient resource allocations and thereby enhancing economic growth on the long-run (Greenwood & Jovanovic, 1990; Bencivenga & Smith, 1991; Bencivenga, Smith & Starr, 1996; King & Levine, 1993). Levine and Zervos (1996) investigated the causal relationship between stock market development and economic growth in the long-run based on pooled regression data of forty-one countries for a period 1976 to 1993. Their findings show a monotonic association between aggregate stock market development and economic growth on the long-run which alternatively means a positive relationship between stock market development and economic growth. Filer, Hanousek and Campos (1999) examined the causality between stock market development and economic growth using Granger causality technique for 70 countries for a period of twelve years ranging from 1985 to1997. They discover little relationship between stock market activity and long-run economic growth, especially for the lower income countries. Kassimatis and Spyrou (2001) appraised the relationship between stock-market, credit-market and economic growth in several emerging economies using causality method. They revealed that in repressed markets, the stock market has either an inverse impact or zero impact on economic growth. Argrawall and Tuteja (2007) investigated the relationship between stock market performance and growth based on pooled data for nine African countries ranging from 1992-1997. They particularly employed simple correlation between some stock market proxies and investment. Their findings reveal a positive relationship between several of the stock market performance indicators and economic growth. Seetanah (2009) explored the complex nexus between stock market development, bank development and economic growth for 27 emerging countries for a period 1991 to 2007. He adopted rigorous panel VAR procedures for his analysis and showed that stock market development is an indispensible factor of growth, but when compared to the other determinants of growth, especially banking development; it has a relative lower magnitude. Nowbutsing and Odit, (2009) studied the effect of stock market development on growth in Mauritius using time series data for the period 1989 -20067. Analyzing both the short run and long run relationships; they conclude that stock market development has positive impact on Mauritius economic growth in both the short run and long run equilibrium position

Olweny and Kimani (2011) investigated the link between economic growth and capital market development in Kenya for the period 2001-2010 using Granger causality and Johansen and Jesulius Co integration techniques. The results of the later confirm a long-run relationship while the former imply that the causality between economic growth and stock market runs unilaterally or entirely in one direction from the NSE 20-share index to the GDP. They concluded that the “movement of Nairobi Stock Exchange reflects the macroeconomic condition of the country and can therefore be used to predict the future path of economic growth”.

Adamopoulos (2010) carried an empirical investigation on the causal relationship between stock market development and economic growth in Germany using time-series data for 1965-2007 periods. He applied Johansen co integration analysis based on the classical unit root tests and found that there is presence of co integration between the variables. Furthermore, the results of the Granger causality reveal a unidirectional causality from stock market performance to growth.

Udaya (2012) employed co integration and vector error correction mechanisms to examine the level of significance (if any) between stock market development and economic growth in Nepal for a period 1994-2011. Satisfying the objective of the unit root test, he found that the variables are co integration at order one.

Antonios (2010) examined the relationship between financial development and economic growth for the period 1965-2007 in Ireland using Johansen multivariate co integration and Granger Causality mechanisms. The results show one co integrating vector which indicate that the specified variables maintain long-run relationship. Also, the Granger Causality test implies that economic growth causes credit market development; while there is bilateral causal relationship between growth and stock market. He therefore, concluded that economic growth has positive influence on the development of both stock and credit markets.

In Nigeria, Mustapha and Yusuf (2013) demonstrated an empirical study on the relationship between Nigerian capital market and economic growth using time-series data that cover a period of 26 years ranging from 1986-2012. They applied co integration technique to examine if there is existence of long run relationship between the variables and found that growth and capital market in Nigeria are co integrated in the long run.

In the same token, Ogege and Ezike (2012) applied Engle-Granger and Johansen Method of co integration and established a long-run relationship between growth and capital market development in Nigeria. The study of (Odetayo and Sajuyigbe, 2012) in Nigeria employs Ordinary Least Squared technique and reveals that stock market has significant impact on the growth of Nigerian economy. The overall shortcoming of these studies in Nigeria is that they fail to examine the direction of causality between growth and capital market development which other studies on this same subject matter had taken care off in some other countries as reviewed above. Thus, the need to shrink this gap by investigating the causality between growth and stock market development becomes empirically inevitable and imperative in Nigeria. Also, to extend the existing studies on this subject matter both in Nigeria and other countries by developing a relationship that embraces growth, stock mark, stock volatility and volatility uncertainty is very vital and demanding and such this current study intends to cover these areas.

**3.1 Method**

The first model that is considered in this study is Autoregressive Conditionally Heteroskedastic (ARCH) specification of (Talor, 1986). The ARCH (1) model in relative to stock market index can be expressed as:

Mind(t) = λ0 + λ1 Mind(t-1) + et  (1)

Et = wtSDmind(t), wt˜ N (0,1) (2)

Volmind(t) = a0 + a1 e2t-1 (3)

Where: Mind(t) represents the composite stock market index of the Nigerian stock market at time (t)

 et is the random error term

 wt is the white noise which is identically and independently distributed.

 SDmind(t) is the standard deviation of the composite market index at time (t) Volmind(t) is the conditional variance of the composite stock market index at time (t) which is the volatility term. Therefore, equation three is alternatively known as conditional variance equation while equation one is known as conditional mean equation.

e2t-1 is the lag one term of the square random error and it represents the ARCH term.

The composite stock market index CSMI can be defined as

Mind(t) = Tc1 - Tc0 x 100

 Tc0  (4)

Where: Mind(t) = CSMI

 Tc1 = total capitalization at current year

 Tc0 = total capitalization at base year

Tc1 = sum of the outstanding share x price at current year

 Tc0 = sum of the outstanding share x price at base year

According to (Vazakidis, 2006; Shan, 2005 and Vazakidis & Adamopoulos, 2009), the composite stock market is considered better than other financial indices as a proxy for stock market performance.

Therefore, in order to test the causal relationship between growth, stock market performance, stock volatility and volatility uncertainty we adopt a model that is close to the multivariate specification of (Antonios 2010, p78).

Thus, the origin of our estimated model can be stated linearly as:

Gr(t) = β0 + β1Mind(t) + β3Volmind(t) + β4UVolmind(t) + µt (5)

Where: UVolmind(t) is the uncertainty of volatility which is a dummy variable that takes values (1) or (0). It is (1) when the volatility value is above average; otherwise zero when the value of volatility is less than average. Other variables had already been defined.

The coefficients β3 and β4 are very paramount in this study. If they are significant, it implies that stock market volatility and it instability have significant impact on economic growth vice-versa.

The study further employs autoregressive distributed lag (ARDL) or bound test approach to co integration because the series of volatility data may be both I(0) and I(1) compliant in nature; therefore, there is tendency that the specified variables in equation (5) are integrated at different orders. The ARDL approach to co integration was originally developed by (Pesaran & Shin, 1999). This approach has advantage over the Johansen and Jesuluis mechanism since it can be applied whether or not variables series are I(0) or I(1). The ARDL representation of equation (5) can be explicitly expressed as:

∂Gr(t) = λ0 + ∑ni = 1 λ1∂Gr(t-1) + ∑ni = 0λ2iMind(t-i) + ∑ni =0 λ3i∂Volmind(t-1) + ∑ni =0 λ4i

∂UVolmind(t-1) +εt + β1Gr(t-1) + β2mind(t-1) + β3Volmindt-1 + β4UVolmind(t-1) + εt

 (6)

 i = (0, 1 …n )

Where: ∂ stands for the 1st difference operator.

 λ0 is the constant representing the drift component.

 εt is the residual error term.

Note that the first set of variables in the right hand side of equation 6 that is the expression with sigma signs (λ1i – λ4i) represents the short-run dynamics of the model while the expression without the sigma signs (β1 – β4) corresponds to the co integration relationship exhibiting the variables.

Thus, we adopt the bound test or ARDL technique under (Pesavan, Shin & Smith, 2001) procedure to estimate the presence of long-run relationship between/among the specified variables. The bound test technique involves computing the F-test or Wald-statistic of the ARDL specification and then subsequently comparing the F-value with the Pesaran’s critical values at the lower and upper bounds. The lower critical value affirms all variable to be I(0) whereas the upper assumes variable to be I(1) in nature. The I(0) means that variables are not co integrated; while I(1) implies presence of co integration. If the calculated or observed F-statistic is equal to or below the lower bound critical value, it means that there is no co integration, conversely, if the observed F-value is equal to or larger than the upper bound critical value, it means that the variables are co integrated, therefore leading to the rejection of the null hypothesis of no co integration. But, if the observed F-statistic falls within the range of values between the lower and upper critical values, it means the test is inclusive.

To look at the speed of adjustment in the short-run disequilibrium, we develop a special version of ARDL error correction mechanism as follows:

∂Gr(t) = α0 + ∑ni = 1 αi1 ∂Gr(t-i) + ∑ni = 0 α2i ∂Mind(t-i) + ∑ni =0 α3i ∂Volmind(t-1) +

∂uVolmind(t-1) +λECM + µit (7)

Where: λ is the coefficient of the speed of adjustment while ECM is the residuals obtained from the co integrating expression of equation (6). The theoretical sign of ladder (λ) is negative and if not it is considered irrelevant since no adjustment can be made.

It is apparent that most studies in Nigeria fail to explain whether growth leads stock market performance or alternatively whether stock market development can be used to predict the variations in the economic growth. We explore Granger Causality Framework to evaluate the directions of causality between these variables including stock volatility and volatility uncertainty. Granger (1969) posited that y is said to Granger cause x; if the lag values of y can be used to predict x better than the past values of x. This is analogously known as unidirectional or one-way causality with the flow from y. but there is existence of bi-directional or two-way causality which says y and x Granger cause each other and we have the zero causality implying the absence of cause and effect in a relationship between y and x. therefore, Granger’s definition of causality is essentially based on predictability. To implement the Granger’s mechanism another version of ARDL Framework with lag length (n) can be specified as:

Mind(t) = λ1 + ∑ni = 1a1imind(t-1) + ∑nj = 1 b1iGr(t-j) + eit (8)

Gr(t) = λ2 + ∑ni = 1 a2iGr(t-i) + ∑nj = 1b2imind(t-j) + e2t (9)

Again, F-statistic or value (F) is computed and compared with the critical F-value (F\*); if F > F\*, we reject the null hypothesis of no Granger causality.

**3.2 Data**

The time series data on economic growth (GDP) and stock market index are sourced from the Central Bank of Nigeria (CBN) statistical bulletin. The data span through the period of 1985 to 2012 in which they are transform to rates in order to maintain the same unit of value for our analysis.

**4. Empirical Results**

We compute the mean, standard deviation sknewness, kurtosis and Jarque Bera statistics of the data series over the period 1985 to 2012. Thus, table 4.1 shows the descriptive statistics for the analysis.

Table 4.1: The Results of the Selected Descriptive Statistics for the Series of Growth, Market Performance, Market Volatility and Volatility Uncertainty for 1985 to 2012

Variable/Series mean Std Dev Skewness kurtosis JB

Gr 0.06 0.05 1.14 4.69 9.43(0.01)

mind 0.14 0.23 -1.79 8.14 45.75(0.0)

Volmind 0.08 0.08 3.00 12.38 144.67(0.00)

Umind 0.36 0.49 0.60 1.36 4.81(0.09)

Note that the values in brackets are the probability values.

Source: Computed from e-View Window 7

Table 4.1 has evidently shown that the mean values of the variables are positive implying that they have increasing tendency throughout the study period. It is noted that volatility uncertainty has the highest mean value and standard deviation while growth rate displays the lowest mean value and standard deviation. We therefore posit that uncertainty of market volatility is more unpredictable than the Nigerian growth rate. We observe that all the series are positively skwened except the series of market index and are leptokurtic except the series of volatility uncertainty. However, the probability values of the Jarque Bera statistics indicate that all the series are normally distributed except the series of volatility uncertainty. This makes us to proceed to the test of the presence of a unit root to further confirm the results of the JB Statistics.

Table 4.2: Unit Root Test Results

**Variable/Series PP0 I(0) PP2 I(1) ADF0 I(0) ADF1 I(1) KPSS0 I(0) KPSS1 I(1)**

**Gr -3.24 (-2.98)\* -6.95 (-2.98)\* -3.26 (-2.98) \* -6.99 (-2.98)\* 0.25 (0.46)\* 0.06 (0.46)\***

**Mind -4.08 (-2.98)\* -17.76 (-2.63)\* -4.11 (-2.97)\* -5.92 (-2.99)\* 0.35 (0.46)\* 0.29 (0.46)\***

**Volmind -4.67 (-2.98)\* -13.39 (-2.98)\* -4.69 (-2.98)\* - 5.03 (-3.00)\* 0.16 (0.46)\* 0.30 (0.46)\***

**UVolmind -4.04 (-2.98)\* -10.31 (-2.98)\* -4.06 (-2.98)\* -7.48 (-2.98)\* 0.09 (0.46)\* 0.03 (0.46)\***

Note: PP0, ADFo, & KPSSo, means observed values of Phillip-paron, Augmented-Dickey-Fuller and Kwiatkowski-Phillips-Schmidt-Shin Statistics at levels respectively; PP1, ADF1, and KPSS1, are the observed values for the respective statistic at first difference; while 1(0) & 1(1) are the respective critical values @ levels and first difference. \* implies significance at 5%.

Source: Computed from e-View Window 7.

The results of the unit root test in respect of the PP, ADF and KPSS statistics are presented in table 4.2. The observed PP and ADF statistics are larger than the critical values at both levels and first difference for all the variables; making us to reject the null hypothesis that the variables are not stationary. To corroborate these tests, we employ the KPSS technique whose null hypothesis says that a variable series is stationary. Looking at the observed KPSS statistics for all the variables, you will discover that they are larger than all the critical values at level and first difference data. Thus, the null hypothesis cannot be rejected, suggesting that the PP, ADF and KPSS techniques provide strong evidence that the variables are integrated at different orders; therefore, Johansen multivariate co integration technique cannot be appropriate in this study. This makes us to proceed to application of bound test or ADRL method to co integration. The ADRL technique assumes that there is only one co integrating vector or long-run relationship between the explained and explanatory variables (see, Pesara, et al 2001) and it is based on the F-statistics or Wald statistics.

Table 4.3: The Results of the Test for Co integration Based on ADRL Technique

Order of lag F-stat Pesaran stat @ 5% Narayan stat @ 5%

 lower bound upper bound lower bound upper bound

1 3.53 3.23 4.35 2.96 3.91

2 1.74 3.23 4.35 2.96 3.91

3 4.65 3.23 4.35 2.96 3.91

Note: the Pesaran and Narayan critical value bounds are extracted from Table CI (iii) with no trend and unrestricted intercept

Source: Computed from e-View Windom 7

The results of co integration test in table 4.3 show that the F-statistic at lag 2 falls below the lower bound level for both Pesaran and Narayan statistics at 5% level; implying that the null hypothesis that the variables are not co integrated cannot be rejected. Also, at lag 1, the F-value falls in between the lower and upper bounds for both statistics. Therefore, there is inconclusive evidence to reject the null hypothesis. However, we noted that F-statistic at lag 3 is larger than the upper critical value for both statistics; thereby rejecting the null hypothesis of no co integration.

The nature of the short-run and long-run relationship as well as the speed of adjustment are obtained from the estimated values of equation 7

Table 4.4: Results of the ADRL Estimation

Panel A: Short-Run Coefficient Estimates

ECM -0.36(0.12)[-3.06]\*\*

Mind 0.41(0.17)[2.50]\*\*

Volmind 3.30(0.66)[4.97]\*\*

Uvol -0.22(0.10)[-2.23]\*\*

Panel B: Long-Run Coefficient Estimations

∆GDP 0.24(0.31)[0.79]

∆Mind -0.02(0.06)[-0.32]

∆Volmind 0.17(0.26)[0.65]

∆UVol -0.05(0.04)[-1.25]

Panel C: Diagnostic Tests

Serial Correlation 10.68(0.83)

Heteroskedasticity 155.79(0.90)

Normality 50.42(0.00)\*\*

Note: The figures in parenthesis and brackets are the standard errors and t-values respectively for panel A and B: while the figures in parenthesis in panel C are the probability values.\*\* implies significant @ both 1% & 5%.

Source: Computed from e-View Window 7

According to panel A in table 4.4, the observed t-values for capitalization index, volatility of market and uncertainty of volatility are 2.50, 4.97 and -2.23. Given a critical t-value 1.71 at 5%; it means that the variables are highly significant in influencing the growth of the Nigerian economy. However, the coefficient of volatility uncertainty is negative meaning that an increase in market volatility uncertainty decreases the rate of economic growth. The adjustment parameter (-0.36) is negative and highly significant. Therefore, the sign of the ECM is theoretical appropriate which means growth, market performance, market volatility and volatility uncertainty are co integrated. The absolute value of the ECM coefficient implies that about 36% of the disequilibrium in growth rate is offset by short-run adjustment in each year. This means that a large growth rate is followed in the next period by a reduction in growth rate; therefore it is necessary to reduce the existing short-run disequilibrium so as to maintain long-run equilibrium.

The corresponding ADRL long-run model results depicted in panel B table 4.4 shows that, market volatility is positively related to growth while market performance and volatility uncertainty are negatively related to growth. This means that the position of the market performance in the short-run has been uttered in the long-run equilibrium position which calls for adjustment. Panel C in table 4.4 displays the results of the diagnostic tests for the ADRL model. The results show that the null hypothesis that the successive residual series are not autocorrelated and heteroskedastic cannot be rejected; while the null hypothesis that the residuals are not normally distributed can be rejected. Thus, it means that the residuals are identically and independently distributed and the model is well fitted.

We employ the VEC Granger Causality and Block Exogeneity Wald Tests to examine the direction of cause/effect between the specified variables. Our results are summarized in table 4.5.

Table 4.5: The Results of the VEC Granger Causality and Block Exogeneity Wald Tests

Variables: D(GDP) D(Mind) D(Volmind) D(UVol)

D(GDP) - 1.39(0.50 2.43(0.30) 1.69(0.43)

DMind 12.50(0.00)\* - 10.01(0.01)\* 6.23(0.04)\*

D(Volmind) 10.32(0.01)\* 0.70(0.71) - 2.63(0.27)

D(UVol) 3.30(0.19) 1.81(0.40) 8.49(0.01)\* -

 Note: the figures without parenthesis are the Chi-squared or LM Statistics while those inside parenthesis are the p-values. The critical LM Statistic is given as 5.99 @ lag 2 with 5% significance level. \* implies significant @ 5%.

Source: Computed from e-View Windom 7

The results reported in table 4.5 are derived from the computed values of equations 8&9. It is discovered from the block exogeneity wald test that market performance and market volatility are exogeneouly determined when GDP is retained as endogeneous variable; market performance and volatility uncertainty are exogeneous when market volatility is transformed to endogeneous variable, while only market performance appears to be exogeneously determined when volatility uncertainty is transformed to endogenous variable. Therefore, it is apparently that only market performance is truly exogeneously determined while only GDP is truly endogeneous in the systems. According to the results of VEC Granger Causality Test, it is estimated that market performance Granger causes growth (GDP), market volatility and volatility uncertainty. Also, it is discovered that market volatility only Granger causes growth, while volatility uncertainty causes market volatility. Thus, we can say that market performance and market volatility lead economic growth in Nigeria implying that growth can be predicted based on the changes in the performance of the stock market and its corresponding shocks/volatility.

**5. Conclusion and Recommendation(s)**

As we have noted, our study is an extension of the existing studies because it has incorporated market volatility and volatility uncertainty into the a-priori or theoretical relationship between growth and capital market development. In consonant with the findings of (Greenwood & Smith 1997), also (Alile, 1984), we discover that there is a presence of monotonic relationship between growth and market performance. Furthermore, the VEC Granger Causality tests show that market development leads economic growth. This is contrary to the claims of the popularly known demand following hypothesis but however, our position is strongly supported by the studies of (Adampoulos, 2010) in Zambia and (Athanasio & Antonios, 2012) in Greece. Our additional findings reveal that market volatility does not only positively affect growth but it causes growth while volatility uncertainty decreases with a rise in growth rate. Thus, we recommend that authorities in the Nigerian capital market should spur more participants into the market through attractive investment media with commeasurable rate of return and stability of such return over a definite time horizon. Also, people’s inordinate affection for consumables should be checked through payment of excessive tax rate on consumables/non-interest yielding assets. This will probably direct and redirect people’s attentions to our ailing stock market at the moment.

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