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MONEY, GROWTH AND EMPLOYMENT IN ECOWAS: AN EMPIRICAL INVESTIGATION

Akpan H. Ekpo[1], **and Jimoh O. Saka**

Abstract

This study examines the inter-relationship among money, growth and employment in the ECOWAS, in the period 1990 – 2014. The theoretical underpinning is the Pigouvian and Modigliani's modification of the Keynesian and neoclassical syntheses which posit that the competitive labour market characterized by a flexible downward money wage in the presence of unemployment ensures the reinforcement of full employment equilibrium. Results of long run relationship test show evidence of long run relationship among money, growth and employment for the ECOWAS countries with disequilibrium percentage error correction highest and significant in the money equation. The long run multivariate Granger causality test results of the VECM obviously shows no causality running from any of the variables in the model both for the full and sub-samples. This reflects the inconsistent policy frame work and poor coordination which has succeeded in creating imbalance in the key macroeconomic policy variables within the region. One of the policy implications arising from this is the need for a rethink of a well-coordinated and consistent policy through an understanding of the behaviour of growth driven policy variables including money supply and employment. Workable investment policy through both public and private sector intervention would help.

Key Words: *Money, Growth, Employment, ECOWAS*
JEL Classification codes: *E12, E13, E20, E24, E52*

1.0 Introduction

Understanding the role of the interrelationship among money, growth and employment in overall macroeconomic performance has been of paramount importance to policy makers. Similar to this argument is the recognition of the relevance of the joint dynamics of employment growth, inflation and output growth for improved macroeconomic performance Philips

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ECOWAS is the Economic Community of West African States comprising Nigeria, The Gambia, Ghana, Sierra-Leone, Liberia, Senegal, Cote-d'Ivoire, Togo, Benin, Cape Verde, Guinea, Guinea-Bissau, Burkina Faso and Mali

(1958, 1962) as cited in Gulielmo and Marinko (2011). The fact that these variables remain target and policy instruments throw more light on why their relationship is crucial in order to avoid operating at sub-optimal levels.

Unemployment is thought of as a lagging indicator and the debate of whether employment is a coincident or lagging economic indicator has remained inconclusive. Unemployment is expected to follow the end of acute recessionary period since investment firms may be unwilling to hire more workers until there are positive signals of economic recovery. Even with economic recovery (if there is any), employment growth may not immediately take off since the number of available jobs created in the economy would have declined during the early recessionary period.

No consensus has been reached in the literature on growth effects of monetary policy. Three variants of argument have supported this namely, the Neo Classical, Monetary and new- Keynesian economists. The New Classical views the effect of monetary policy on real economic activity as being persistent over time based on gradual adjustment of individual prices with credibility playing a major role in the money-real economic activity relationship. Monetarists including Friedman advocate for the avoidance of major monetary shocks to the macro-economy. The idea that money would grow at a constant rate sufficient enough to accommodate trend in productivity growth is in force. For the new-Keynesians, monetary policy may be effective when the economy is not on a recessionary phase.

The movement towards full employment equilibrium is ensured through the interaction between the stock of money and the money wage and thus by the money wage flexibility. Role of money in employment has been much debated within the Keynesian and the classical models. The latter advocates effect of money on income through interest rate transmission mechanism. Increasing money supply lowers interest rate for aggregate consumption and investment to rise; thus increasing employment (Froyen, 2005).

The link among the above macroeconomic variables may originate from a careful study of the inter-link between any two of the variables. Borrowing the idea from the movement towards full employment attainment following expansive monetary policy, increasing aggregate demand is a positive signal to economic growth improvement. The non-optimality condition and inadequate knowledge of the relationship among money, growth and employment tends to partly result in macroeconomic instability and failures in the developing economies. Overall, this often leads to inappropriate economic policy formulation. As strong motivation for the study, aside from little concentration of

empirical works on the long run relationship among money, growth and employment in the case of ECOWAS, the study creates an avenue for a further understanding of the relationship among these macroeconomic variables and making this highly beneficial particularly to the policy makers of the region; thus, this complements the efforts towards the development of effective macroeconomic stabilization polices within the region. Subsequently, this study examines the inter-link among money, growth and employment.

The paper is organized as follows: Following the introduction, some stylized facts and theoretical literature are considered in sessions two and three, respectively. Session four examines the modeling frame work while session five provides results and inherent analysis. Session six concludes the paper.

2.0 Some Stylized Facts

The Economic Community of West African States (ECOWAS) makes up a significant proportion of Africa's economy in comparison with other seven Regional Economic Communities (RECs). The region recorded 18.5% of the total average GDP in 2003-2012 with 40.0% of agricultural sector in total agricultural GDP during the same period.

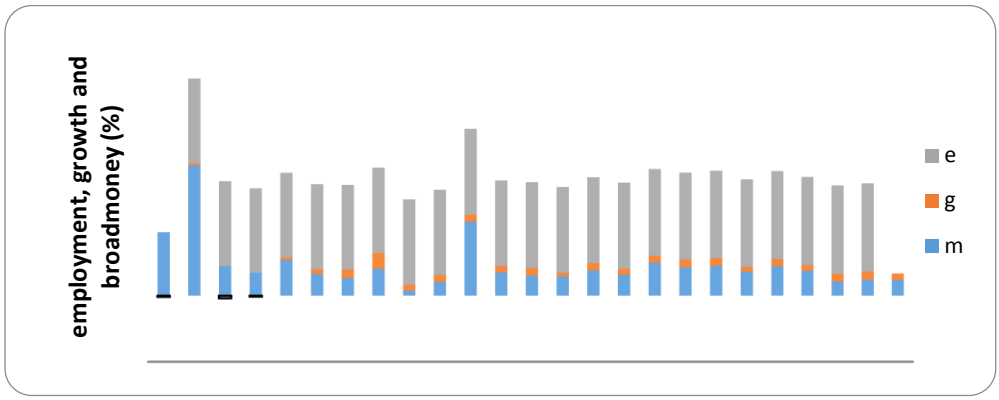
With respect to agricultural sector, Nigeria accounts for the largest share of the REC's agricultural GDP. Ghana is next followed by Cote-d'Ivoire and Mali. Cape Verde is characterized as having the smallest share of ECOWAS's agricultural GDP followed by The Gambia.

On a year by year analysis, since the early 80s, the region has been having a significant improvement in her economic performance. However, according to the average growth rate, the region was characterized by negative growth rate of -0.9,-1.9 and -0.7 during the 1990, 1992 and 1993, respectively. Accordingly, the highest average growth of 11.9% occurred in 1997 followed by 6.2% in 1996. The rationalization behind this may lie in the increasing trade performance of some ECOWAS member countries within the then sixteen member states structure. Precisely, Nigeria and Coted'Ivoire contributed about 80% of the intra-regional exports in 1994-1996. However, the lowest positive growth was 2.6% in 2003. The non-uniform growth experienced in the region may reflect the quality of implementation of various macroeconomic policies by economies in the sub-region.

The sub-region's GDP growth is projected to reach 7.1% by end of 2015 with Nigeria accounting for about 78% of the entire GDP. The decline in the projected prices may reduce the projected growth rate for the region.

A steady growth including macroeconomic stability requires coordination of fiscal and monetary policies. The four largest economies of ECOWAS: Nigeria, Coted'Ivoire, Senegal WAEMU and Ghana have undertaken monetary policy reforms since the late 1980s. This became necessary in order to liberalize the money market and to increase central bank autonomy among other objectives. Average broad money growth fluctuated during the 1990-2014 with highest growth of 98.3% in 1991 and lowest of 3.8% in 1998. Between 1999 and 2014, money growth ranged between 56.0% and 10.30%.

Figure 2.1: Employment, Gdp and money (growth in %) for ECOWAS (1990-2014)



Source: Average computed from The World bank database

Despite the positive growth recorded, the social situation still remains unsteady. While improvement seemed to occur in a few countries, economic malaise and inequalities are still rampant. Programmes meant to facilitate job improvement have not been sustainable and hence mobilization of investments seemed difficult. The average employment rate ranged between 63% and 67% between 1990 and 2014. The highest average employment rate was 66.7% during 2012 and 2013 with the lowest average of 63.6% in 1991. The employment rate data provided is not however convincing to believe that unemployment is low. The continent is still characterized by declining productivity as a strong unemployment cost, high rate of poverty, poor infrastructural facilities and insecurity exercabated by persistent corruption and poor governance.

Policies put in place to create jobs at the regional, sub-regional and national levels have had limited positive impact on the economy of the region: rates of unemployment remain high (about 30 percent) while the incidence of poverty is rising.

3.0 Brief Review of Literature

The interlink between money, growth and employment may be discussed through the link between any two of the variables. The review therefore throws light on the link between money and growth, money and employment and growth and employment and finally among the three.

Is money relevant in growth theory?

The position of money in growth theories has been examined in extant literature. Kiyataki and Wright (1989), Banerjee and Maskin (1996) and Luo (1998) among others have argued that one of the functions of money can be directly related to the origins of money. Samuelson (1998) highlights the function of money in overlapping-generation model, where money facilitates the reallocation of resources across generations. Doepke and Scheider (2013) provide a model describing the role of money as a unit of account. Money as a medium of exchange has set the pace for the negligent treatment of money in specific aspect of growth theories and tends to justify the neutrality assumption of money. This implies that nominal variables do not seem to affect the real variables that actually determine the economy.

The negligence of growth theory in money seems to be clear because basically the theoretical paradigm focuses more on the fundamental mechanism of the growth process; notwithstanding, issue of finance plays a relevant role and act as lubricant in reducing friction (Aghion and Howitt, 2009, p 129). The fundamental mechanisms such as technological progress including its determining factors such as R&D, patent laws, individual preferences and scarcity of resources are presumed as long term issues (Aghion and Howitt, 2009; Barro and Sala-i-Martin, 2004, Romer, 1990). This implies that the level of an economy's steady-state is determined by these factors through the marginal productivity of capital. Net investment no longer become relevant for growth in the steady state since depreciation rate is at par with capital productivity.

Contrary to the above, monetary variables may have a short-run effect on the economy along the growth-path towards the steady state. This supports the assertion that money appears to be neutral in the long run but not in the short run (Mankiw, 2009, p 684). Hence neutrality is technically seen as a one-time change in money supply leaving the real variables unaltered but with effects on the price level. Within the dynamic context, super neutrality is a relevant term implying that real variables become unaltered consequent upon a change in the growth rate of money supply. In the classical sense, neutrality separates nominal and real variables. Therefore, the scope for monetary policy becomes apparent during

the short-run economic fluctuations with no relevant role of money during the long term.

Some conceptualization in growth theories has perceived money as a good entering the utility function, remaining super neutral in the long run and as well as providing its explicit definition as a medium of exchange . These are bases for the non-crucial nature of money and are therefore seen not to either support or hamper other fundamental mechanisms of growth and as such it does not occupy a central role in explaining growth.

Money-induced growth spiral

Binswanger's (2012, 2006) "growth spiral" theory first started with a critique of neoclassical treatment of money. Through referencing the work of Keynes, he provided a different perspective on the role of money in the economy. According to him, fiat money appears to be a necessary condition for stimulating a modern and steadily-growing economy. The emphasis is on the role of money as a means of payment with central focus on the credit role as advance money which it plays on the economy including promoting factors of production. Such advanced money emanates from individual firms and externally. Owing to scarcity, advance money comes with a price such as interest for credits and dividends for the shares. Hence, this necessitates the need for the firm to generate sufficient profit to keep up with payment to its shareholders and creditors.

On the aggregate, there exists as much money in the economy as injected by firms; thus, enhancing the initial factors of production. Hence, the model gives a clue that firms also create purchasing power for their own products indirectly. Firms' profits are possible if only they invest at least as much as their production from the immediate past period (including profits). Based on psychological research (Lindgren, 1991), the assumption is on the acceptance of money by owners of the factors of production. Households too may use interest income of banks in the payment of the value added by the firm. However, the argument is that banks need to keep certain portion of their interest income as reserves so as to expand credit availability in the future (Binswanger, 2009; Freydorf et al, 2012; Wenzlaff et al, 2014). Consequently, the need to create demand for its products and for the banks to keep some of its profits for reserve purpose necessitates the need for the firms to demand more advance money in each period. The new credit-money again requires profit to enable the firms pay bank interest, thus essentially constituting a growth imperative. This scenario would make it difficult to stabilize the economy.

Money- Employment nexus

According to Keynes, fiscal and monetary policies can influence the aggregate demand and affect employment level while the classical, monetary and real business cycle asserts the reverse and that the real factors including education, technology and capital formation do influence employment. Similarly, government should have no role to play but should increase real factors to increase productivity and hence influence aggregate supply (Froyen, 2005).

Keynes and his cohorts emphasize that high unemployment is a consequence of deficiency in aggregate demand. The use of monetary and fiscal policies is advocated to stimulate aggregate demand. Accordingly, potential fiscal policy such as fiscal stimulus can enhance government spending, tax cuts, and increased transfers to create employment. Consequently, increased consumption and investment would increase the employment level (Froyen, 2005).

An expansionary monetary policy can help stimulate the economy, especially at the recovery stage. According to Keynes, a transmission mechanism through which money affects income is interest rate. Increasing money supply reduces the real interest rate and in turn increases the consumption and investment and hence aggregate demand. This tends to have a positive effect on employment (Froyen, 2005).

On the view of the monetarist, an expansionary monetary policy can move the unemployment rate below the natural rate just temporarily with a trade-off between unemployment and inflation occurring for a short run period. Money supply only has a long run impact on the price and other nominal variables. The unemployment rate tends to return to the natural rate with the effect that expansionary policy causes a higher inflation rate (Froyen, 2005). To the classical, monetary and real business cycle economists, real factors are relevant in the determination of the "wealth of nations and that free market provides an optimal level in the absence of state control.

Growth-Employment relationship

The link between employment and growth is not new in the literature. Improvement in growth can lead to reduction in unemployment and vice versa. Deficiency of capital relative to labour and the existence of backward technology can lead to a low average productivity of the work force. If increasing growth can sustain increase in productive capacity, employment opportunities accompanied by increasing productivity can be generated.

Essentially, a more progressive absorption and integration of unemployed and underemployed into the rapid growing economy can then be encouraged (Islam, 2004).

These processes create higher productivity of the poor including increasing their incomes in their current occupation, or possibly make a shift towards a higher level skills or better technology. Results of the process may originate from improved productivity of various sectors and occupations, a shift occurring to the structure of employment towards occupation with higher levels of productivity and real wage increase, earnings generated from self-employment and wage employment.

Causality could run from employment to growth. With higher earnings from growth impact, workers are able to spend on education and attainment of better skills for their children, thus raising workforce productive capacity which essentially achieves higher growth levels. Hence, the virtuous circle of economic growth leading to poverty reduction through employment growth is completed (Islam, 2004).[2]

The linkage between growth, employment and poverty may be better explained through a demand-supply approach. From the demand side, the variables growth employment intensity, shifts in the employment structure towards higher productivity sector, technology; assets creation for the poor are expected to influence incomes of the poor. The supply side include such factors as the ability of the poor to get integrated into the process of economic growth and getting access to the jobs that are created. Getting integrated to economic growth process is a function of the levels of education and skills of the workforce (Islam, 2004). Thus, the demand-supply approach essentially points out the relationship among growth, employment and money.

The foregoing provides the basis for the empirical studies in the study of money, growth and employment. Padalino and Vivarelli (1997) demonstrate through empirical evidence that aggregate economic growth contributes to employment particularly in the short run. Sagent (2000) studies the relationship between growth and employment selected transition economies for 11 years. Her analyses show that there appears to be no relationship existing between output

[2] Graph of variables does not capture employment data for 1990 and 2014 due to data inadequacy. The acronyms used for employment, Gdp growth and money are respectively e, g and m

growth and employment level during the post-transition period for Bulgaria and Ukraine. Norazlina and Yasmiza (2011) carry out a study on employment and macroeconomic variables for Malaysia, Philippines and Singapore in which the long run relationship is evaluated among employment, output, private capital formation among other variables from 1975 to 2004. Their results support existence of cointegration.

Guglielmo et al (2011) carry out a study titled "Employment growth, inflation and output growth: Was Philip Right? Evidence from a Dynamic Panel". There exists a long run relationship between employment growth, inflation and output growth in Philips tradition in a large panel of countries. Bidirectional relationship exists between the variables except from inflation to output which is unidirectional. However, previous works on money, growth and employment have been grossly inadequate particularly for the ECOWAS and thus making this study to be relevant.

4.0 Theoretical specification

The traditional and Keynesian theories have generated a hot debate in connection with the theory of employment. While the former maintains that a full employment level remains a point of stable equilibrium in the economic system as competitive market exists, the latter asserts the possibility of underemployment equilibrium. The Keynesian theory is successful both culturally and in respect of policy in which fiscal and monetary intervention serves to control for unemployment given the devastating effect of the Great depression.

Using the simplified versions of Pigou and Modigliani models, and suppose labour supply is l_0 (given), labour demand l_d is seen as a decreasing function of the real wage due to flexibility of the capital-labour ratio. An increasing real wages makes utilization of the labour factor more advantageous thus incentivizing the choice among the available productive techniques of a more capital intensive (more labour intensive) technique than the one in use before the increase in wages. The converse is also true.

The existence of unemployment in a competitive labour market gives room for excess supply of labour which pushes down the real wages, making capita-labour ratio to decline. This development raises labour demand so that unemployment is reabsorbed.

Suppose y is the real income with e, employment, w, is the money wage with, p the price level and m the total money supply. This accompanies the inverse

of the velocity of money popularly called Cambridge k with first and second derivatives. The 'Pigou pre-Keynes' model which expresses the main stream macroeconomic theory before Keynes can be set out in a simplified version as follows:

$$y = y(e),\ y' > 0,\ y'' < 0 \tag{1}$$

Equation (1) gives the identity between the real income and employment in which the assumption of decreasing marginal productivity of labour comes into play.

$$\frac{w}{p} = y'(e) \tag{2}$$

In equation (2), the labour market equilibrium is described; here the real wage is set equal to the marginal productivity of labour.

$$m = k.p.y \tag{3}$$

Equation (3) essentially describes the endogenously fixed money supply-monetary income relationships. The decomposition of monetary income in the price and quantity elements and thus employment are determined by the exogenous money wage.

$$\frac{m}{w} = \frac{k.y(e)}{y'(e)} \tag{4}$$

Equation (4) is a derivative of equations (1), (2) and (3) and implies that the stock of money (money wage) and the employment level are directly related. Full employment is achievable for any given money wage, through an expansion of the money supply resulting in an increase in prices and real wage reduction.

The modification of the neoclassical theory is illustrated in the Pigou's macroeconomic theory and the Modigliani's neoclassical synthesis. This is clearly shown through investment i, savings s, interest rate r and v, the velocity of circulation of money. To accomplish the task, the study measures, i, s and v in wage units in line with the Keynes general theory.

$$i = i(r), i' < 0 \tag{5}$$

$$s = s(r, y), s_r' > 0, s_y' > 0 \tag{6}$$

$$i = s \tag{7}$$

Equation (5)-(7) represent the investment –saving relationship, the IS function

$$w.y = m.v(r), v' > 0 \quad (8)$$

$$y = y(e)\,,\ y' > 0, y'' < 0 \quad (9)$$

$$r = r(y), r' < 0 \quad (10)$$

Equation(11) is systematically derived from equations (8) through (10).

$$\frac{m}{w} = y / v\left[r(y)\right] \quad (11)$$

This (equation 11) essentially shows the direct relationship between the stock of money expressed in wage units and the level of production. Equation (9) explains the link between income level and employment. These again reemphasize the full employment equilibrium consequent upon the flexibility of the relation between money stock and the money wage, and also the flexibility of unemployment through competitive conditions in the labour market. The equations that follow are illustrations of the 'neoclassical syntheses

$$s = s(r, y), s_r' > 0, s_y' > 0 \quad (12)$$

$$i = i(r, y), i_r' < 0, i_y' > 0 \quad (13)$$

$$i = s \quad (14)$$

$$y = y(e), y' > 0, y'' < 0 \quad (15)$$

$$y'(e) = \frac{w}{p} \quad (16)$$

$$w = \alpha w_0 + (1-\beta) y'(e)\, p\ , \quad (17)$$

$$\frac{m^d}{p} = l(r, y) \quad (18)$$

$$m^d = m^s \quad (19)$$

$if\ \alpha = 0,$ (full employment level)

then systems of equations in (12) through (19) produce three fundamental results: The IS , LM and the real wage equations. Real wage being a function of employment.

$$r = r(y), r' < 0 \tag{20}$$

$$\frac{m}{p} = l(i, x), l_i' < 0, l_x' > 0 \tag{21}$$

$$\frac{w}{p} = x'(e), x'' \leq 0 \tag{22}$$

Equations (20), (21) and (22) can be expressed in a more compact form as:

$$\frac{m}{w} = l\frac{[r(y), y]}{y'(e)}, \frac{dy}{d(\frac{m}{w})} > 0 \tag{23}$$

On the basis of the main features of the models; i.e, given money wage, employment is an increasing function of the money supply. And given the money supply, employment is a decreasing function of money wage. The competitive labour market characterized by a flexible downward money wage in the presence of unemployment ensures that it reinforces full employment equilibrium. With money wage rigidity, an expansionary policy can aid the necessary condition of the real wage through increasing prices. This obviously shows the theoretical linkage among money, employment and output growth. The full employment equilibrium seems however unattainable given that all resources are not fully utilized and thus the existence of output gap.

The foregoing has provided some theoretical foundation of the link among money, growth and employment. This link is further empirically evaluated through examining the long run relationship among the variables in question. Essentially the use of panel cointegration becomes necessary here. The study employs the Johansen Fisher Panel Cointegration test which is non-residual based. This test uses the results of the individual independent tests (Fisher/Johansen). As used by Maddala and Wu(1999), Fisher's results proposes an alternative approach to testing for cointegration in panel data through combining tests from an individual cross sections to derive a test statistic for the full panel.

Suppose π_i = p -value obtained from an individual cointegration test for cross-section i , then for the null hypothesis for panel;

$$-2\sum_{i=1}^{N}\log(\pi_i)\longrightarrow\chi^2_{2N} \tag{24}$$

By default, this is reported as χ^2 values based on Mackinnon-Haug-Michelis (1999) p -values for the trace and maximum-Eigen value tests. These are obtainable from the long run relationship among money, growth and employment for the specific case. The long run equation is

$$g_{it} = a_i + b_i t + c_{1i} m_{it} + c_{2i,t} e_{it} + \mu_{it} \tag{25}$$

$t = 1,.....,T; i = 1,....,N; m = 1,...,M$ where T is the number of observations, N the number of individual countries present and M the number of regressors. a, b, c_1, c_2 are constants and μ , error term. It is expected that $b, c_1, c_2 > 0$

The vector error correction model (VECM) specification is

$$\Delta g_{it} = \mu_{it} - \theta_1(g - \beta_0 - \beta_1 m - \beta_2 e)_{it-1} + \sum_{i=1}^{j}\delta_{1,j}\Delta g_{1it-i} + \sum_{i=1}^{j}\delta_{2,j}\Delta m_{1it-i} + \sum_{i=1}^{j}\delta_{3,j}\Delta e_{1it-i} + \varepsilon_{1it} \tag{26}$$

$$\Delta_{it} m = \mu_{it} - \theta_2(g - \theta_0 - \theta_1 m - \theta_2 e)_{it-1} + \sum_{i=1}^{j}\Phi_{1,j}\Delta g_{2it-i} + \sum_{i=1}^{j}\Phi_{2,j}\Delta m_{2it-i} + \sum_{i=1}^{j}\Phi_{3,j}\Delta e_{2it-i} + \varepsilon_{2it} \tag{27}$$

$$\Delta_{it} e = \mu_{it} - \theta_3(g - \theta_0 - \theta_1 m - \theta_2 e)_{it-1} + \sum_{i=1}^{j}\omega_{1,j}\Delta g_{3it-i} + \sum_{i=1}^{j}\omega_{2,j}\Delta m_{3it-i} + \sum_{i=1}^{j}\omega_{3,j}\Delta e_{3it-i} + \varepsilon_{3it} \tag{28}$$

Where g is growth rate, m is money supply and e , employment rate. β , θ , ϕ and ω are constants.

Equations (26)-(28) state the error correction term for each of the variables in turn. This essentially allow for comparison of coefficients.

With cointegrating relationship, analysis of the dynamic causal interactions among the variables is expressed in a vector error correction form. This allows both the long run and short run causality to be assessed on the χ^2 -squared test of the

lagged first differenced term and the t-test of the error correction term. The direction of causality follows with the specifications:

$$\Delta g_{it} = \tau_{0i} + \tau_{1i}\Delta m_{it} + \tau_{2t}\Delta e_{it} + \mu_{it} \quad (29)$$

$$\Delta m_{it} = \rho_{0i} + \rho_{1i}\Delta g_{it} + \rho_{2t}\Delta e_{it} + \mu_{it} \quad (30)$$

$$\Delta e_{it} = \lambda_{0i} + \lambda_{1i}\Delta g_{it} + \lambda_{2t} m\Delta_{it} + \mu_{it} \quad (31)$$

Where τ, ρ and λ are constants

Data for money, growth and employment spanning 1990-2014 are obtained from the World Bank database. Employment data for 1990 and 2014 are, however, not available indicating that missing values are inevitable.

5.0 Main Results and Discussion

Table A1 of the Appendix describes the statistical characteristics of the money, growth and employment variables. Employment variable has the highest mean and median values of 65.06 and 66.00, respectively followed by the money supply variable (23.97 and 14.20). The increased mean and median values of the employment reflect its growth trend compared to other variables. However, looking at the poverty dimension in the economy, this is still extremely low and as does not portray any overall positive effect on welfare. Money supply however, demonstrates highest degree of fluctuation given its standard deviation of 81.67 This is also in line with the increasing growth rate of money supply overtime. Kurtosis coefficients for the variables are positive with highest value of 189.35 for money supply. Employment rate is negatively skewed (-0.23) over the period and is normally distributed (0.00).

A preliminary test of multicollinearity using correlation matrix of zero order on the same table shows that any two of the variables display low correlations. The highest positive correlation coefficient is 0.014 found between money and employment. Hence, there tends to be low collinearity between the variables serving as explanatory. This is reconfirmed using the variance inflation factor computed as 1.00, an indication that the variance of the coefficient in each case is inflated by a factor of 1.00 only. This value is extremely low, thus further indicating absence of multicollinearity.

Table A2 in the Appendix displays the test of equality of means and variances of the series. Both the Anova and Welch F tests show that the means across cross-sections are significantly different from one another (prob=0.00) while variances

across sections are equally significantly different based on Bartlett, Levene and B-F tests (prob=0.00). This also further indicates varying degree of fluctuations across series.

Table 1: Panel Unit Root test

	method	**statistics**	**Probability**	**order of integration**
m	Levin, Lin & Chu t*	-7.42	0.00	Level
g	Levin, Lin & Chu t*	-3.94	0.00	Level
Δe	Levin, Lin & Chu t*	-2.48	0.01	First difference

Source: Authors computation

The panel unit root test is carried out in table 1 above. Apart from being asymptotically normally distributed, the power of the test increases. The results show that only the employment variable remains stationary at its first difference. Money supply and growth variables are stationary in their level forms.

Table 2: Unrestricted Cointegration Rank of money, growth and employment series

Countries: 15 ECOWAS countries 12 ECOWAS countries 10 ECOWAS countries

Hyp. No of CEs	Trace	prob	Max-Eig	prob.	trace	prob.	Max-Eig	prob.	Trace	prob.	Max - Eig	prob
$r \leq 0$	118.7	0.00	80.53	0.00	130.20	0.00	110.20	0.00	104.10	0.00	91.09	0.00
$r \leq 1$	65.01	0.00	51.05	0.00	47.67	0.00	38.79	0.00	43.20	0.00	29.01	0.00
$r \leq 2$	58.47	0.00	58.47	0.00	42.22	0.00	42.22	0.00	50.13	0.00	50.13	0.00

Source: Authors' computation using E-Views

Various long run relationship scenarios are displayed in table 2. For the whole sample (15 ECOWAS countries, both the Trace and Max-Eigen test statistic confirm cointegration among the variables with 3 cointegrating vectors. Thus given the number of cointegrating vectors, it is expected that the relationship is stable. This relationship follows what is established in theory that given the perfectly competitive market where unemployment exists, the excessive supply of labour forces down the real wage rate and this theoretically increases employment and thus unemployment is reabsorbed in the system.

Following the issue of instability in ECOWAS countries, the study conducts the long run relationship test by dropping some countries on the basis of instability. Instability here is measured by the fragility index computable from a composite of indicators involving demographic pressures, economic decline, brain drain, levels of foreign assistance, among others. This is based on the Fund for peace's preparatory Conflict Assessment System (CAST) platform. On the basis of Fragility State Index 2014, Nigeria, Niger and Liberia are categorized as under "Alert" and are dropped from the list. The results of the remaining 12 countries still show 3 cointegrating vectors for both Trace and Max-Eigen values. The study again utilizes 10 countries now dropping Burkina Faso, Togo, Senegal and Sierra Leone under "high warning". Results are not different from the first two showing that fragility seems not to affect the long run relationship among money, growth and employment in the ECOWAS. Hence, we specify the long run equation for the complete sample as follows taking growth as explained.

$$g = \left(-131.89 - 3.78m(-1) - 0.22e(-1)\right) \quad (32)$$

[11.89] [0.90]

The long run equation indicates the negative impacts of money and employment on growth after coefficient reversal even though money appears significant. The results show that increasing money supply retards growth. If according to Friedman, inflation is and always a monetary phenomenon then cumulative increase in money supply into the region results in inflation and this tends to retard growth process. Thus, money supply seems to have an indirect relationship with growth in the region. Employment has an unexpected negative relationship. Intuitively, this is a signal that current employment is far below what could trigger growth. Low productive capacity, low aggregate demand and thus low level of growth are indications of unemployment problems.

Following the long run cointegration equation, we proceed to estimating the long run VECM.

Table 3: Multi-variate Granger Causality Estimation Results based on VECM

	χ^2 **-squared statistics lagged first difference term. P-value in [ ]**									
	Full sample				**12 countries**			**10 countries**		
dep. var.indep. var	Δg	Δm	Δe	ect_{-1}	Δg	Δm	Δe	Δg	Δm	Δe
Δg	------	0.035 [0.983]	0.016 [0.992]	-0.002 [0.361]	-------	0.881 [0.644]	0.416 [0.812]	-----	1.035 [0.596]	0.396 [0.820]
Δm	0.834 [0.659]	-------	2.386 [0.303]	-0.278 [-11.867]*	3.876 [0.144]	----------	1.398 [0.497]	1.738 [0.419]	---------	1.602 [0.449]
Δe	1.552 [0.460]	5.791 [0.055]	-------	-0.001 [-1.678]	3.849 [0.146]	4.492 [0.106]	-------	0.182 [0.913]	4.720 [0.094]	-------

Source: Authors' computation

Table 3 presents the results of the long run VECM (only for the full sample) and the multivariate Granger causality test for each of the variables in equilibrium. With cointegrating relationship, analysis of the dynamic causal interactions among the variables is expressed in a vector error correction form. This allows both the long run and short run causality to be assessed on the χ^2-squared test of the lagged first differenced term and the t-test of the error correction term.

For the full sample, the error correction coefficient is significantly negative (-0.278) for the money equation as expected. Thus, about 28% of short run disequilibrium is corrected for per year whereas; about 0.2% and 0.1 % of short run disequilibria are corrected respectively for the growth and employment equations.

The multivariate causality test results for the full sample for each of the variables serving as dependent in turn shows no evidence of causality running from any direction. This implies that, money and employment do not cause growth, growth and employment do not cause money supply and money supply and growth do not cause employment. The results are similar when we carry out same analysis

using sub-sample of countries. The only exception is that money causes employment marginally in the analysis of 10 countries. The non- causality reflects the improper understanding of the relationship among these variables coupled with frequent unstable and unsuitable policy framework which tends to create imbalance among key macroeconomic policy variables among which are money, growth and employment.

6.0 Conclusion

Inadequate understanding of macroeconomic interrelationships has often made it difficult to set the required target for growth driven policy variables. This more often is attributed to the quality of governance. The weaknesses in the policy direction are some of the factors stagnating the region's growth and development. The relationship among money, growth and employment examined in this study using causality analysis of the vector error correction model provides no strong evidence of causal relationship between any two of the variables at the conventional level with various sub-samples utilized; even though there exists strong evidence of cointegration as presumed by theory. The perceived causes of the non-causal relationship are not far from long period of policy mismatch, inconsistency, ignorance of the workings of the system further aggravated by high level of endemic corruption. It is therefore important to have a rethink through proper policy frame work and better understanding of policy variables that are growth driven including employment and money supply. The level of employment rate is too low to bring about a meaningful increase in aggregate demand and growth. Workable investment policy through both public and private sector intervention would help.

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APPENDIX

Table A1: Descriptive Statistics Correlation

	M	G	E		M	g	E
Mean	23.97	4.28	65.06	M	1.000	0.002	0.014
Median	14.20	4.15	66.00	G	0.002	1.000	-0.091
Std Dev	81.67	9.02	8.18	E	0.014	-0.091	1.000
Skewness	12.72	2.77	-0.23	VIF	1.000	1.000	1.000
Kurtosis	189.35	52.20	2.85				
J-B	0.00	0.00	0.18				

Table A2: Test for Equality of Means and Variances between Series

Method	**degree of freedom**	**Value**	**Probability**
Bartlett	2	2069.97	0.00
Anova F-test / Levene	2, 1078 / 2,1078	150.45	0.00
Welch F-test / B-F	2,641.68 / 2,1078	4494.22	0.00

Source: Authors' computation using **EViews**

CHINA-AFRICA TRADE RELATIONS: GROWTH IMPLICATIONS FOR ECOWAS COUNTRIES

Leonard Nosa Aisien[1]*, Sam Guobadia **, and Milton A. Iyoha***

Abstract

The Economic Community of West African States (ECOWAS) comprises fifteen West Africa countries and covers a total land mass of 5,112,908 square miles. Although the countries boast abundant resources they have long been plagued with problems of poverty, high unemployment rate and wide income inequality. However, current statistics show that ECOWAS countries recently witnessed an impressive growth performance. The period of high growth also coincides with the period of high trade relations between ECOWAS countries and China. This has raised an unanswered question as to whether or not the period of high growth performance in ECOWAS states and period of high trade relationship with China occurring at the same time is a mere coincidence. This study utilizes empirical data from the fifteen ECOWAS countries for the period 1992-2014 making a balanced panel of 331 observations to generate empirical results to answer this question. It adopts the Generalised Method of Moment (GMM) estimator using internal instruments in order to take care of the potential endogeneity of trade and other variables, especially reverse causation of growth and trade. The results from this study reveal that China's trade with ECOWAS has a positive and significant impact on economic growth in ECOWAS countries. This suggests that the recent economic growth performance of ECOWAS states occurring simultaneously with upswing in trade relations with China is not a mere coincidence. However, the results show that it is the imports from China that significantly support growth in ECOWAS states. Exports from ECOWAS countries to China are found not to be a robust determinant of economic growth in ECOWAS states. On the basis of the empirical findings, the study concludes that imports from China are crucial for growth in ECOWAS countries at their current level of development as these enable them to benefit from the technological transfer associated with such relationship. However, the sustainability of such growth in the long run depends on the ability of ECOWAS countries to utilize this technological transfer to develop their own productive base and improve their export commodities through value added processing of raw materials and light manufacturing.

***Key words*:** Economic growth, ECOWAS, China, Export, Import
***JEL Classification*:** F43

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1.0 INTRODUCTION

The Economic Community of West African States (ECOWAS), which is a major regional Economic unit of Sub-Sahara Africa, was established on May 28, 1975, in Lagos, Nigeria. The primary objective for the formation of ECOWAS is to promote economic and monetary integration and foster improved trade relations among member states. The signing of the ECOWAS Treaty of Lagos provides a kind of radical response to the problem of poverty, economic sluggishness and underdevelopment bedeviling the West Africa sub-region over the years and as such the much-desired framework for the realization of rapid and sustainable socio-political and economic development throughout the sub-region.

ECOWAS covers a total landmass of 5,112,903 square miles and a population of approximately 300,646,263 people with a combined Gross Domestic Product (GDP) of over US$676.21 billion as at 2013 (WDI, 2013). It is currently made up of fifteen countries which include Nigeria, Benin, Cape Verde, Burkina Faso, Liberia, Côte d'Ivoire, The Gambia, Guinea, Mali, Sierra Leone, Niger, Ghana, Senegal, Guinea–Bissau and Togo. The initial membership of ECOWAS was sixteen, but Mauritania withdrew its membership in 2001. Although the Sub–Region is rich in natural resources, it is inhabited by people long plagued with the problem of poverty and economic sluggishness. It is also faced with the problem of coping and defining its place in a rapidly changing global economy.

West Africa, like other regions of Africa, is gradually becoming a destination for trade by world super powers. Most industrialized countries of the world (United States, European Union, and China) are currently striving to win a larger share of the African market. This is a new scramble for the continent of Africa.

The emergence of China as one of the world economic powers is one of the most important economic developments in recent years. According to China's National Bureau of Statistics, China's GDP reached almost US$2.25 trillion in 2005 and US$7.31 trillion in 2011. China currently accounts for an increased share of global output and its export performance has become formidable, contributing significantly to the global economy.

China's recent exploration of Africa is driven by a desperate need to find oil and other industrial raw materials to meet its increasing resource needs as one of the fastest growing economies in the world. Given its rapid industrialization, China seems to be faced with industrial overproduction compared to its domestic market. Chinese firms are, therefore, equally in need of cultivating new export markets for their manufactured goods. Idun-Arakhurst and Laing (2007) note that

China in its search for resources and new export market for their products has turned to Africa, which boasts vast and untapped natural resources.

Africa, as noted by the United States Government Overseas Private Investment Corporation offers the highest return on investment compared with other regions of the world (Pineau, 2005). This may have informed the new scramble for Africa's business landscape with China taking the lead. China's trade with African countries has increased greatly in recent years. Available statistics from UN COMTRADE database, indicate that there has been a great increase in the trade volume between China and African countries. In 2006, for example, Africa's trade with China hit over US$56.5 billion as against about US$4 billion a decade earlier. As noted by De Grauwe, Houssa, and Piccillo (2012), China's shares in Africa's trade has risen dramatically from less than 1 percent in the 1980s to about 13 percent in 2009. From recent trade statistics, China accounts for a larger share of trade with African countries compared with any individual European country.

Coincidentally, these recent years also have witnessed a robust growth for many Sub–Saharan Africa countries with West Africa posting the highest growth rate. (AfDB et al, 2014). Africa until recently witnesses an unprecedented economic growth rate with some of the countries being coined the 'lion economies' (Kosciejew, 2012).

The growth of China-Africa trade is not without controversy. Recent estimates show that the export of primary products largely driven by Chinese demand accounted for about one-third of Africa's economic growth in the past decade. (Rotberg, 2008). However, there is a debate as to whether or not such growth can be sustained or can assist development in African countries. The long-term benefits of exporting primary products particularly in their crude form have long been questioned. The former South African President, Thabo Mbeki, in 2006 warns that if African countries continue to export raw materials alone to China, the continent could be condemned to underdevelopment (BBC news, 2006). Many economists have argued that trade with China is hindering industrialization and lacks job-creation effects or ability to trigger activities in other key sectors of the economy (Kaplinsky, 2007).

On the other side of the divide, there are economists who are convinced of the positive benefits of the rapidly growing China-Africa trade. They argue that growth often starts with the primary sector doing well, and resource exports today are paying for infrastructure and human capital improvement that will sustain growth in the future (Lin, 2012).

The impact of China-Africa trade on growth in Africa is, therefore, a complex issue, but a full understanding of their ramifications is important. The extent to which Africa's trade with China is causing growth, and if it is sustainable in the long run clearly have important implications for the living standards of Africans and for the long-term development of the continent.

Most recent studies on China-Africa trade relations have focused on disaggregated trade flows and their determinants. Specifically, most of them have concentrated on testing the validity of the gravity model of trade (see Cheung et al, 2012; Renard, 2011; Geda and Meskel, 2007; Zafar, 2007; Blum and Goldfarb, 2005; and Buch, Kleinert, and Toubal, 2004). There seems to be a dearth of empirical research on the impact of China-African trade on economic growth in Sub-Saharan Africa. Specifically, to the extent of available literature reviewed in this study, there are no known empirical studies in this direction devoted to the ECOWAS sub-region which houses Africa's largest economy. The lack of empirical studies on this issue for ECOWAS countries has created some gaps and unanswered questions particularly on the growth potentials of the region's trade with China.

There had been good growth performance in ECOWAS until 2013. At the same time, China- African trade relationship has improved significantly. Could the growing trade relations between China and ECOWAS countries be linked with the growth performance in the sub- region? This is an unanswered question. Hence, there is a need to examine the impact of ECOWAS-China trade relations on growth in ECOWAS countries in the context of various control factors that could also determine growth.

This study is, therefore, an attempt to fill the gap by providing empirical evidence on the growth implications of the burgeoning China-Africa trade for ECOWAS countries as a group.

To this end, the paper is divided into five parts for ease of presentation. Part I is this introduction, Part II is a review of literature while Part III contains analysis of the Theoretical framework including model specification and estimation. Parts IV and V are the empirical Results and Recommendations, respectively. The latter contains the Conclusion.

II. Literature Review

There is a robust literature on the relationship between trade and economic growth in both developed and developing countries. Some of those studies are based on single countries while others are based on a panel of a different number of countries. Studies such as Olusegun, et al. (2009), Adelowokan and Maku

(2013), Ugochukwu and Chinyere (2013), Arodoye and Iyoha (2014), Fosu and Magnus (2006), Nabine (2009), and Peng and Almas (2010) are based on single country trade with the world. Sachs and Warner (2005), Frankel and Romer (2009), Karbasi et al. (2005), Abdullahi, Umar and Mohammed (2013), Busse and Koniger (2012), Josheski and Lazarov (2012), and Calderon and Poggio (2010) use panel data.

Apart from the conventional literature on the impact of international trade on economic growth, it is important to turn to the specific literature on the Africa-China relation. As the political and business connections between Africa and China are becoming closer and tighter, scholars and policymakers are paying more attention to China's activities in Africa.

A greater proportion of the studies on China-Africa trade relation focus on the issues of the determinants of trade patterns (using gravity equation), costs and benefits for different Sub-Saharan Africa (SSA) countries, and the impact of import competition. A literature review of these is contained in Giovanetti *et al.* (2009). Very few studies have been devoted to the overall relationship between China-African trade and economic growth of SSA countries. Specifically, studies found in this direction are Chen (2007), Baliamoune-Lutz (2011) and Stapleton (2013).

Chen (2007) investigates the impact of Chinese trade alone on African growth, using a panel of 47 Sub-Sahara African countries in the period 1961-2005. Controlling for endogeneity issues and institutional effects, the study finds evidence to suggest that Chinese trade has had a positive impact on African economic growth.

Baliamoune-Lutz (2011) uses the Arellano-Bond GMM estimations on panel data for the period 1995-2008 to explore the growth effect of Africa's trade with China. After controlling for the role of export concentration, some important results were obtained from the empirical analysis**.** First, there was no empirical evidence that exports to China enhance growth unconditionally. Second, the results suggest that export concentration enhances the growth effects of exporting to China, implying that countries which export one major commodity to China benefit more (in terms of growth) than those countries that have more diversified exports. Finally, the evidence suggests that there is an inverted-U relationship between exports to developed countries and growth in Africa. Overall, the results seem to provide support for the hypothesis of growth by destination (i.e., that where a country exports its products to matters...for the exporting country's growth and development).

Stapleton (2013) has examined the role of trade with China in Sub-Saharan Africa recent economic growth using a panel of 46 SSA countries for the period 1992-2009. The findings of the study reveal that volume of export to China was positively associated with economic growth in SSA over the past two decades.

These results show positive growth effects from China-African trade. However, the study conducted by Giovannetti and Safilippo (2009) reveals otherwise. This study employs disaggregated analysis to examine the indirect effect of China-Africa trade on Africa economic growth. Based on disaggregated data for the period 1995 – 2005, their results provide evidence of the existence of displacement effect of Africa product at different levels. Specifically, results show evidence of displacement for a number of African industries especially textiles and clothing and even more in footwear. Also affected are manufactured chemicals and non-metallic mineral products. On the basis of their findings, Giovannetti and Safilippo conclude that with China flooding African markets with its low-cost products, China products are crowding out African manufactured goods and this would have an adverse effect on the future self-sustaining growth of Africa.

The following observations have been made from the review of literature:

i. Trade is proxied by total trade (import + export) in most studies on impact of trade on economic growth. None of the empirical studies reviewed examines the component of trade that drives growth in sub-Sahara Africa. A clear understanding of the component of trade (import or export) that is more significant in explaining the growth in Africa has important implications for policy formulation. This study fills this gap by disaggregating total trade into exports to and imports from China. The impact of each of these trade components on economic growth in ECOWAS states is estimated and analyzed.

ii. Many of the studies in the literature reviewed are based on a panel of several countries. However, the panels are composed of selected sub-Saharan African countries not linked by common boundaries. None of the studies considers the impact of trade on a panel of countries in a bloc closely connected by common boundaries. It is important to note that growth in one country can spill over to neighbouring countries. To capture the full growth effect of trade, a panel of countries within the same geographical location connected by common boundaries is most ideal. Hence, this study adopts a panel of fifteen ECOWAS countries which occupy the West African region of Africa for the empirical analysis.

III Theoretical Framework

This study relies on the endogenous growth theories to establish the theoretical link between trade openness and economic growth. This was well captured in the models of Grossman and Helpman (1991) and Rivera-Batiz and Romer (1991). These models identify four different effects that openness to international trade has on long run economic growth. These are the communication, duplication, allocation, and integration effects.

i. **Communication effects:** Trade openness promotes economic growth by providing channels of communication between domestic producers and their foreign counterparts. This facilitates the transmission of technology which aids growth.

ii. **Duplication effects:** Trade openness helps to prevent duplication of research and development efforts. This encourages firms to invent new and distinct ideas.

iii. **Allocation effects:** Trade openness helps a country to allocate its resources to the most productive uses, stressing comparative advantages; countries specialize according to their comparative cost advantages or resource endowment. This leads to increase in the level of research and development in their areas of specialization leading to long-run growth.

iv. **Integration effects:** Trade openness increases the size of the market for firm's products leading to economies of scale. With enlarged markets, research and development activities will increase in search of new ideas and product development to meet increased demand. This promotes economic growth. On the other hand, with openness to international trade, domestic firms will face foreign competitions which may lead to losing of some market shares at home. This implies that integration may not be beneficial to less developed countries. It was in line with this thought that Alesina et al (2005) and Feenstra (1996) conclude that integration effect may not be beneficial to small countries.

It is obvious that, among these different effects, the communication, allocation and duplication effects necessarily raise economic growth. However, the influence of integration effects is not unambiguously positive. Therefore, it is possible to conclude that the influence of openness to international trade on long run economic growth depends on the magnitude and dominance of these different effects. Hence, these models do not necessarily predict that openness to international trade leads to economic growth in all circumstances and for all countries. In other words, whether openness causes economic growth depends on country-specific conditions. Despite these facts, there is a common presumption that openness leads to higher output level and growth in developing

countries. Hence, this study is to verify the growth impact of Africa trade with China on ECOWAS members.

III.I Model Specification and Estimation Methods

a. Model Specification

The Solow model forms the basis for most empirical investigation of economic growth. Mankiw, Romer and Weil (1992) build on the Solow model to develop a benchmark equation upon which subsequent cross-country studies are based. The Solow version of the neoclassical growth model derives the growth rate of per capita output given as

$$[\log y(t) - \log y(0)] = g + \eta[\log \tilde{y}(t)^{*} - \log y^{\wedge}(0) + \log A_i(0)] \quad (1)$$

where:

$[\log y(t) - \log y(0)]$ = growth rate of per capita output

g = growth rate of technical progress

$\tilde{y}(t)^{*}$ = steady state level of output per unit of effective labour

$y^{\wedge}(0)$ = initial level of output per unit of effective labour

$A_i(0)$ = initial level of technology in country i

$[\log \tilde{y}(t)^{*} - \log y^{\wedge}(0)]$ = difference between initial level of output per unit of effective Labour and its steady state.

The above equation means that growth rate of per capita output is inversely related to the initial level of output per unit of effective labour while it is positively related to the steady state level of output per unit of effective labour. However, as time (t) approaches infinity (i.e as an economy converges to its steady state) the effect of the second factor becomes zero. This means that in the long run, the growth rate of per capita output is determined by the rate of technological progress (g).

If it is assumed that rate of technological progress, *g* and the determinants of the steady state level of output per unit of effective labour are constant across countries, then each economy approaches the same steady state in the long run. That is why countries with a lower initial level of output per unit of effective labour grow faster than those with a higher initial level of output per unit of effective labour during the transition period. This results in what is known as the **absolute convergence hypothesis** and predicts that countries that started with a relatively lower initial capital labour ratio tend to catch up with those with higher initial values of capital-labour ratio and per capita output. However, if the countries have different values of *g* and determinants of the steady state value of output per unit of effective labour, then steady states will be different across countries. Therefore, each economy will converge to its own steady state rather than a common steady state and the speed of this convergence will be inversely

related to the distance of the initial level from the steady state. This property is a result of the assumption of diminishing returns to capital so that economies which have less capital per head relative to its steady state level tend to have higher rates of return and so achieve faster growth. In this situation, the neoclassical growth model implies *conditional convergence* instead of absolute convergence. In general, convergence hypothesis implies that an economy with a lower initial value of per capita output tends to generate higher growth rate of per capita output if *g* and determinants of the steady state value of output per unit of effective labour are the same across countries or their effects are controlled.

Equation (1) forms the basis for the estimation of cross – country growth regressions in the empirical growth literature. Adding an error term, which is independent from all right-hand side variables, yields the following cross-country growth regression

$$[\log y_i(t) - \log y_i(0)] = g + \eta \log \tilde{y}_i(t)^* - \eta \log \hat{y}_i(0) + \eta \log A_i(0) + \mu \quad (2)$$

Where subscript *i* denotes the country *i*.

Equation (2) is the basic cross-country growth regression derived from neoclassical Solow-Swan growth model.

Mankiw, Romer and Weil (1992) augment the Solow-Swan version of neoclassical growth model by adding the accumulation of human capital. They assume a Cobb-Douglas production function such that production at time *t* in country *i* is given by

$$Y_i(t) = K_i(t)^{\alpha} H_i(t)^{\beta} [A_i(t) L_i(t)]^{1-\alpha-\beta} \quad (3)$$

Where:

Y = Output,
K = Physical capital,
H = Human capital,
A = Level of technology.
L = Labour,

Mankiw et al (1992) assume decreasing returns to both kinds of capital, which means that $\alpha + \beta < 1$, and labour stock and the level of technology are assumed to grow exogenously at rates *n* and *g*, respectively as before. The model also assumes a constant fraction of output is invested in both physical and human capital such that S_K is the fraction of income invested in physical capital and S_H is the fraction of income invested in human capital. From equation (3) and denoting depreciation as ð, is derived the augmented growth equation given as:

$$[\log y_i(t) - \log y_i(0)] = g + \eta\frac{\alpha}{1-\alpha-\beta}\log S_{iK} + \eta\frac{\beta}{1-\alpha-\beta}\log S_{iH} - \eta\frac{\alpha-\beta}{1-\alpha-\beta}\log(n_i + g + \delta) + \eta\log y_i(0) + \eta\log A_i(0) + \mu \quad (4)$$

Mankiw et al assume that:

i. Rates of technological progress and of depreciation are constant across countries.

ii. The logarithm of initial level of technology is assumed to be different across countries and to be equal to the sum of a fixed parameter, *a* and a country-specific shock, *ei* such that

$$\log A_i(0) = a + e_i \quad (5)$$

iii. The level of initial technology represents not only the technology but also the resource endowment, institutions, climate and so on. Therefore, initial differences across countries are reflected by the term *ei* .

Substituting equation (5) into equation (4) the study has

$$[\log y_i(t) - \log y_i(0)] = g + \eta a + \eta\frac{\alpha}{1-\alpha-\beta}\log S_{iK} + \eta\frac{\beta}{1-\alpha-\beta}\log S_{iH} - \eta\frac{\alpha-\beta}{1-\alpha-\beta}\log(n_i + g + \delta) - \eta\log y_i(0) + \mu + \eta e_i \quad (6)$$

The cross-country growth regression in equation (6) can be written in its reduced form

$$\delta_i = \lambda_0 + \lambda_1\log y_i(0) + \lambda_2(n_i + g + \delta) + \lambda_3\log S_{iK} + \lambda_4\log S_{iH} + \nu_i \quad (7)$$

where :

$$\delta_i = t^{-1}[\log y_i(t) - \log y_i(0)]$$
$$\lambda_0 = g + \eta a$$
$$\lambda_1 = -\eta$$
$$\lambda_2 = -\eta\frac{\alpha-\beta}{1-\alpha-\beta}$$
$$\lambda_3 = \eta\frac{\alpha}{1-\alpha-\beta}$$
$$\lambda_4 = \eta\frac{\beta}{1-\alpha-\beta}$$
$$\nu_I = \mu + \eta e_i$$

Equation (6) and its reduced form in (7) are the bases of the augmented neoclassical growth model.

The growth equation is further extended by adding other variables suggested by the new growth theories. This can be written as:

$$\delta_i = \lambda_0 + \lambda_1\log y_i(0) + \lambda_2(n_i + g + \delta) + \lambda_3\log S_{iK} + \lambda_4\log S_{iH} + \Phi Z_i + \nu_i \quad (8)$$

Where Z is a vector of additional explanatory variables suggested by the new growth theories. Among these additional explanatory variables suggested by the

new growth theories is trade. The theoretical link between trade and growth has been explained in the theoretical framework of this study.

Therefore, the core model for this study is given as:

$$lnGDPPC_{i,t} = \Phi + \lambda_0 lny_{i,t\_base} + \lambda_1 lnCAP_{i,t} + \lambda_2 HC_{i,t} + \lambda_3 POPGR_{i,t} + \pi_1 lnEXCHINA_{i,t} + \pi_2 lnIMCHINA_{i,t} + e_{i,t} \quad (9)$$

Where the previously undefined variables are :

$lnEXCHINA$ = Total export to China
$lnIMCHINA$ = Total import from China
lny_{i,t_base} = GDP per capita for the base year
$lnCAP$ = Gross fixed capital formation
HC = Human capital
$POPGR$ = Growth rate of population
$LnTCHINA$ = Total trade with China
$e_{i,t}$ = Stochastic error term

This equation is for country *i* at time *t*.

In addition to the core model, other control variables are included to prevent omitted variable bias. First, it is not unreasonable to believe that there have been general trends over time not captured in the other variables. TREND is added to control for such an effect. Also, in the light of literature linking institutional quality and economic growth, the World Governance Indicator of Quality of Institution is also included, chosen due to its common use in literature. Countries with better institutional quality tend to attract more investment, have better infrastructure and higher productivity; influencing growth and development.

Finally, in order to consider the effect of natural resources, an oil dummy variable is included for oil-producing countries. There is a body of literature which stresses the negative relationship between natural resources and economic growth, for example, Collier and Goderis (2008), due to lack of investment in education and infrastructure, corruption and conflict. The final model is represented as:

$$lnGDPPC_{i,t} = \Phi + \lambda_0 lny_{i,t\_base} + \lambda_1 lnCAP_{i,t} + \lambda_2 HC_{i,t} + \lambda_3 POPGR_{i,t} + \pi_1 lnEXCHINA_{i,t} + \pi_2 lnIMCHINA_{i,t} + \pi_3 OIL + \pi_4 INST + \pi_5 TREND + \varepsilon_{i,t} \quad , \quad (10)$$

where the previously undefined variables are

OIL = Oil dummy
$INST$ = Quality of institution
$TREND$ = Time trend

b. Estimation method

The estimation of the above models is faced with some challenges. There are reasons to believe that many of the right-hand variables in equation (10) such as export to China, import from China, human capital, gross fixed capital formation, and population growth may have reverse causality with per capita GDP. This violates the strict exogeneity assumption of the least squares estimators. This is referred to as endogeneity problem. There is also the usual problem of heterogeneity associated with panel data estimation. Given these problems, the least squares estimators will yield biased estimates.

Most studies have tried to eliminate these problems using the fixed effects and random effects estimators. While this may help to eliminate the problem of heterogeneity, the endogeneity problem remains. In order to address this problem, this study relies on the system Generalized Method of Moments (GMM) estimator, which was developed by Lars Peter Henson in 1982 and popularized, by Arellano and Bover (1995) and Blundell and Bond (1998).

One important aspect of the GMM is the test for over-identification restriction. This is to ensure that the model moment condition matches the data well. Hence, this will ascertain whether or not the instruments are valid. It is important that the moment condition is met. If not, the estimate is driven by invalid instruments and the resulting estimate will be inconsistent. In this study, the validity of the instruments is tested using the J test.

The robustness of the estimates is examined by conducting sensitivity analysis on the sign and significance of the variable of interest, trade with China. This is done by introducing other growth determinants outside trade variables. These include the rate of inflation, the size of government, infrastructural development, and financial development. Each of these variables is introduced one at a time to see the impact on the sign and significance of variable of interest. The consistency of the sign and significance of the variable of interest (trade with China) shows that its impact is robust; otherwise it is fragile.

I. Empirical Results

This section presents the estimation results of specified models using the Generalised Method of Moments (GMM) estimator. The estimation is based on fifteen ECOWAS countries for the period 1992 – 2014 which gives a balanced panel of 331 observations. The results are presented step by step to clearly demonstrate the sensitivity analysis and robustness checks of estimates.

The empirical results from the GMM estimation are presented in table 1 below:

Table 1: GMM Estimates of the disaggregate Trade model

	1	**2**	**3**
d ln EXCHINA	0.009*** (1.717)	0.009*** (1.659)	-0.0002 (0.054)
d ln IMCHINA	0.012** (2.298)	0.012** (2.229)	0.004* (2.613)
ln YBASE	0.565* (17.421)	0.586* (18.795)	0.606* (21.886)
d ln CAP	0.076** (2.565)	0.076* (2.659)	0.084* (3.836)
d ln POPGR	-0.698* (8.137)	-0.684* (8.314)	-0.569* (7.733)
d ln HCP	0.135** (2.269)	-	-
d ln HCS		0.068* (3.071)	
d ln HCT			0.136* (7.381)
CONSTANT	3.194* (8.156)	3.405* (10.873)	3.179* (12.189)
R – Squared	0.736	0.747	0.799
S. E of Reg	0.308	0.301	0.268
J – Statistics	0.063	0.061	0.050
Dependent variable: lnGDPPC			

In the above table, column 1 shows the estimates of the core model using primary school enrolment as proxy for Human Capital development. Columns 2 and 3 shows estimate of the core model using secondary school enrolment rate and tertiary education enrolment rate, respectively.

From the results, import from China is significant all through with a positive sign. This shows that imports from China have positive impact on economic growth of ECOWAS states. Exports to China on the other hand also have positive and significant impact in the first two models where primary school enrolment rate and secondary school enrolment rates are used as proxy for human capital development. However, when tertiary education enrolment rate is used, the export variable is no longer significant and the sign changes to negative. This is an indication that export to china may not be a strong and consistent determinant of economic growth of ECOWAS states. This is, however, subject to other robustness test. To check for the robustness of the estimates of the variable

of interest, other explanatory variables were introduced in a step wise manner. The results are presented below:

Table 2: GMM estimates of Augmented disaggregated trade model (Robustness test)

	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)		(3c)	(4a)	(4b)	(4c)	(5a)	(5b)	(5c)
dlnExCHINA	0.015* (2.664)	0.014** (2.373)	0.005 (0.988)	0.016** (2.221)	0.015** (2.043)	0.005 (0.731)	0.017** (2.379)	0.017** (2.278)		0.007 (1.068)	0.017** (2.026)	0.015*** (1.816)	0.009 (1.225)	0.013 (1.455)	0.012 (1.335)	0.007 (0.851)
dlnImCHINA	0.042* (4.113)	0.056* (5.113)	0.033* (3.638)	0.044* (3.943)	0.053* (4.654)	0.032* (3.328)	0.038* (3.658)	0.043* (4.153)		0.022* (2.542)	0.0378* (3.639)	0.041* (3.927)	0.024* (2.679)	0.031* (2.771)	0.029** (2.385)	0.014** (2.301)
ln YBASE	0.507* (14.593)	0.555* (16.994)	0.579* (20.139)	0.518* (13.693)	0.564* (16.356)	0.598* (19.667)	0.493* (13.031)	0.514* (13.947)		0.554* (17.122)	0.489* (11.732)	0.501* (11.754)	0.571* (15.672)	0.422* (8.930)	0.431* (9.158)	0.509* (12.603)
dln CAP	0.042 (1.473)	0.053*** (1.755)	0.064* (2.711)	0.042 (1.439)	0.052 (1.683)	0.064* (2.764)	-0.003 (0.091)	-0.005 (0.131)		0.022 (0.791)	-0.002 (0.053)	-0.002 (0.051)	0.019 (0.739)	0.052** (1.699)	0.064** (1.982)	0.075* (2.873)
dln POPGR	-0.681* (7.965)	-0.728* (8.144)	-0.609* (7.276)	-0.684* (7.722)	-0.715 (0.911)	-0.583* (6.818)	-0.639* (6.961)	-0.647* (6.932)		-0.536* (5.999)	-0.640* (6.973)	-0.649* (6.937)	-0.531* (5.991)	-0.672* (6.738)	-0.669* (6.677)	-0.549* (5.742)
dln HCP	0.308* (5.847)	-	-	0.279* (4.643)	-	-	0.167* (2.737)	-		-	0.162* (2.525)	-	-	0.111 (1.545)	-	-
dln HCS	-	0.072* (2.838)	-	-	0.066* (2.909)	-	-	0.035*** (1.841)		-	-	0.032*** (1.709)	-	-	0.046** (2.402)	-
dln HCT	-	-	0.137* (6.719)	-	-	0.132* (6.577)	-	-		0.117* (5.904)	-	-	0.121* (5.888)	-	-	0.123* (6.063)
dln INST	0.214* (7.218)	0.169* (5.133)	0.156* (5.593)	0.198* (6.528)	0.160* (4.777)	0.149* (5.349)	0.186* (6.255)	0.164* (4.909)		0.144* (5.147)	0.183* (5.425)	0.156* (4.240)	0.154* (4.944)	0.153* (4.117)	0.122* (3.234)	0.130* (3.964)
TREND	-0.051* (5.614)	-0.047* (5.253)	-0.046* (6.292)	-0.052* (4.692)	-0.047* (4.469)	-0.043* (4.982)	-0.053* (5.094)	-0.051* (5.009)		-0.048* (5.447)	-0.053* (4.377)	-0.049* (4.209)	-0.051* (5.192)	-0.042* (3.057)	0.041* (3.143)	-0.044* (4.034)
OIL	0.221* (6.395)	0.186* (5.297)	0.127* (4.709)	0.222* (6.064)	0.188* (5.152)	0.121* (4.358)	0.228* (6.221)	0.211* (5.797)		0.149* (5.474)	0.225* (5.896)	0.203* (5.436)	0.155* (5.478)	0.209* (8.080)	0.196* (5.159)	0.146* (5.139)
dln INF	-	-	-	0.004 (0.304)	0.012 (0.940)	0.020*** (1.883)	0.014 (1.228)	0.021*** (1.757)		0.027* (2.635)	0.021*** (1.788)	0.021*** (2.484)	0.026**	0.003 (0.223)	0.007 (0.575)	0.012 (1.167)
dln FIN DEV	-	-	-	-	-	-	0.184* (4.133)	0.213* (4.832)		0.167* (4.272)	0.015 (1.182)	0.210* (4.657)	0.169* (4.377)	0.242* (4.656)	0.252* (5.106)	0.214* (5.131)
dln FRAST	-	-	-	-	-	-	-	-		-	0.184* (4.123)	0.009 (0.711)	-0.010 (1.025)	0.035** (2.237)	0.012 (0.963)	
dln GOVT	2.392* (6.868)	3.309* (10.175)	3.109* (10.861)	2.493* (6.624)	3.217* (9.233)	2.941* (9.427)	2.694* (7.299)	3.131* (9.007)		2.829* (9.140)	0.003 (0.204)	-	-	0.031** (1.764)	-0.236* (4.946)	-0.203* (5.241)
CONSTANT											2.732* (6.479)	3.222* (8.439)	2.717* (8.165)	-0.221* (4.264)	3.656* (9.058)	3.099* (8.711)
R – squared	0.762	0.742	0.790	0.759	0.747	0.799	0.759	0.753		0.800	0.758	0.751	0.803	0.739	0.737	0.792
J – statistics	0.043	0.046	0.039	0.044	0.048	0.039	0.041	0.041		0.036	0.041	0.041	0.036	0.035	0.034	0.030

t statistics in bracket * significant at 1% ** significant at 5% *** significant at 10% Dependant variable: lnGDPPC

ii) Implications of Result:

The following are some important implications of the above estimation which may be useful for policy formulation:

(a) Import from China to ECOWAS countries is a robust determinant of economic growth of ECOWAS countries.
(b) Export to China from ECOWAS countries is not a robust determinant of economic growth of ECOWAS countries. Its impact is highly sensitive to other explanatory variables in the model.
(c) On the basis of (a) and (b) above, economic growth of ECOWAS countries is import dependent. This means that economic growth of ECOWAS states is import driven with regard to trade with China. This finding is against theoretical expectation. However, this can be explained. Imports from China comprise consumer goods and investment goods. The consumer goods from China which are relatively cheap are imported by domestic entrepreneurs and sold in the local markets making high profit. This contributes to the national income of the domestic economy thereby boosting economic growth. On the other hand, Increase in investment goods, all things being equal, will boost production activities in the domestic economy leading to increase in economic growth. However, over dependent on import as source of growth may have some implications for growth sustainability and economic variability to external shocks.
(d) Oil producing countries of ECOWAS will likely benefit more from the trade with China.
(e) Human capital development, population growth, quality of institutions, financial development and the size of government are robust determinants of economic growth in ECOWAS countries.
(f) The large size of Government of members of ECOWAS is inimical to economic growth. This may reflect to the fact that a large proportion of government expenditure of member countries is not productive.
(g) The convergence hypothesis is not valid for ECOWAS countries.

2 Recommendations

Empirical evidence from this study indicates that trade with China has had a positive and significant impact on economic growth in ECOWAS states. On this basis, the following policy recommendations will help to increase the benefits from ECOWAS – China trade relation:

i. There should be deliberate policy action on the part of governments of ECOWAS states to promote more trade relationship with China. ECOWAS countries should as a matter of policy, re-evaluate and lower

trade barriers (tariff and non-tariffs) of their respective countries in relation to imports from China. These imports from China provide ECOWAS countries access to cheap industrial goods which directly promote economic growth. Additionally, they serve as close substitutes to expensive goods from Europe and America, thereby bringing the goods to the reach of the common man, hence increasing economic wellbeing of the citizens.

ii. There should be more aggressive and practically oriented approach to human capital development. Greater proportion of graduate unemployment in many of the ECOWAS countries is due to lack of requisite skills on the part of the graduates. A well trained and educated work force will be more flexible and adaptable to modern technology. The educational curriculum needs a general overhauling. There is a need to introduce more entrepreneurial and skill development studies into educational curriculum as well as more investment into technical education. This will help the countries to benefit more from the technological transfer derived from trade with China.

iii. There is urgent need for policies towards products diversification. The growth effect of imports from China is far more than that of exports from ECOWAS to China, reflecting the fact that exports from ECOWAS are primary products without value added. They are so cheap that their value is low. ECOWAS countries should begin to look into the prospects for value added processing of raw materials and light manufacturing. Processing of local raw materials before exporting them to China will add value to their export, creating some employment opportunities and hence economic growth. The import-driven growth currently experienced by ECOWAS countries is only sustainable and more robust in the long run if it is augmented by improved export earnings.

Conclusion

The current upswing in ECOWAS trade with China has growth implications for ECOWAS states. Empirical evidence from this study shows that the robust growth experienced by most ECOWAS states until the Africa pulse of 2015 is largely driven by imports from China. Exports from ECOWAS States to China cannot be said to

be robust determinant of growth in ECOWAS countries. This is not unconnected with the nature of the exports from these countries, which are basically primary products. Imports from China are crucial for growth in ECOWAS states at their current level of development as they enable the countries to benefit from technological transfer usually associated with such relationship. However, the sustainability of such growth in the long run depends on the ability of ECOWAS countries to utilize this technological knowledge received to develop their productive base and diversify their export commodities through value added processing of raw materials and light manufacturing.

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ECONOMIC GROWTH EFFECT AND MACROECONOMIC DETERMINANTS OF INTEREST RATE SPREAD IN NIGERIA

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Abstract

The objective of the paper is to investigate the economic growth effect and determinants of interest rate spread in Nigeria. The ARDL (Bounds test) approach to cointegration and error correction mechanism is employed for analysis of data spanning the period, 1981 through 2014. The empirical evidence indicates that higher interest rate spread adversely affect economic growth in the short- and long-run, though the long-run effect is not statistically significant. The study further finds that interest rate spread is wider following higher monetary policy rate, inflation, government domestic debt and cash reserves ratio, and narrowed (lowered) as a result of higher treasury bills rate. Considering the negative effect of high interest rate spread on economic growth, the paper recommends for policy consideration, channeling of efforts towards reduction (narrowing) of the spread through reduction of monetary policy rate, targeting of low inflation, reduction of government borrowing, reduction of the cash reserves ratio and increase of the treasury bills rate.

Keywords: Interest Rate Spread, Economic Growth, Commercial Banks

JEL Codes: E43, E52, E58, G21, O44

1.0 INTRODUCTION

Interest rate spread refers to the difference between lending interest rate and deposit (or savings) interest rate of commercial banks. Wide interest rate spread results mainly from high lending rate and relatively low deposit rate. The implications of wide interest rate spread for investment, savings and economic growth are that investment is discouraged by high lending interest rate; the desire to save in financial institutions (banks) is adversely affected by low deposit rate (and this adversely affects banks' deposit which is the main determinant of their lending capacity (Aigheyisi and Oaikhenan, 2014; Aigheyisi 2015), and the ultimate effect of these is that economic growth would also be adversely affected.

Low spread caused by low lending interest rate may adversely affect credit supply considering that the lending interest rate (being a price – price or cost of

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loan) is a key determinant of supply of credit. It also affects commercial banks' interest income which constitutes a major source of profitability for the banks. Hence, while high lending interest rate acts as a disincentive to private sector investment, low interest rate spread engendered by low lending interest rate, could be a disincentive to commercial banks' lending to private sector investors which require bank loans.

Interest rate spread in Nigeria generally oscillated (fluctuated) upwards between 1981 and 2014. Official statistics from the Central Bank of Nigeria **Statistical bulletin** (2015) indicates that interest rate spread in the period averaged 9.88%, and ranged between -0.25% in 1985 (when savings interest rate was 9.50% and prime lending interest rate was 9.25%), and 20.70% in 2002 (when savings interest rate was 4.15% and prime lending interest rate was 24.85%). The high lending interest rates (prime and maximum) charged by the lending institutions (commercial banks) reflects the interplay of a number of factors including the high monetary policy rates (formerly known as the minimum rediscount rate), which is the benchmark interest rate set by the regulatory bank (the Central Bank) in its bid to control money supply and inflation in the economy; inflation and expected inflation which reduce the real interest rate, thereby prompting the lending institutions to charge higher interest rate on loans extended; the desire of the commercial banks to increase their interest incomes; and the higher government borrowing etc.

Figure 1 shows the trends in the interest rate spread, economic growth rate (measured as the growth rate of real GDP per capita) and the monetary policy rate of the Central Bank of Nigeria in the period under review.

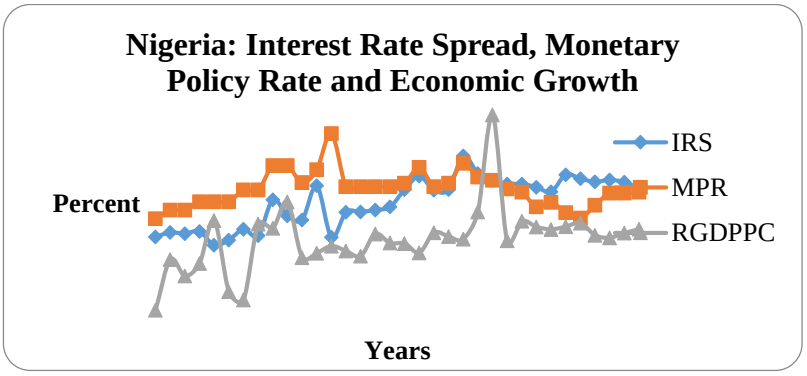


Figure 1. Trends in Interest Rate Spread, Monetary Policy Rate and Real GDP per capita Growth Rate of Nigeria (1981-2014).

Figure 1 clearly shows that the trend in interest rate spread tracks the trend in monetary policy rate in most of the period. The similarity in trends suggests that

the minimum rediscount rate or the monetary policy rate (MPR) is a determinant of interest rate spread and that higher MPR tends to be associated with wider interest rate spread. Though there appears to be no clear-cut relationship between the trends in IRS and real GDP per capita growth, and MPR and real GDP per capita growth, it can, however, be observed that in most of the period, upward trends in IRS and MPR were associated with downwards trends in the growth rate of real GDP per capita. The absence of clear-cut relationship between IRS and MPR, and real GDP per capita growth in some part of the period under review could be attributed to the fact that numerous factors apart from these variables (IRS and MPR) accounted for the growth of the economy.

The empirical literature on the macroeconomic determinants of interest rate spread in Nigeria is still quite lean. This paper therefore represents a contribution to the extant literature, especially in area of methodology applied. Previous studies have employed panel data analysis for their investigations. This study employs the ARDL (Bounds) test approach to cointegration and error correction analysis developed by Pesaran, Shin and Smith (2001). The choice of this methodology is informed by the fact that it could be applied in cases involving data series that are of mixed order of integration; it is relatively more efficient in cases of small and finite data sizes; and it yields unbiased estimate of the long-run model with a valid t-statistics in spite of regressor endogeneity (Harris and Sollis, 2003).

This study arguably blazes a trail in its investigation of the effect of the interest rate spread on economic growth in Nigeria as there is no such prior study in extant literature. It therefore seeks to fill an obvious gap.

The paper has a two-fold objective: to examine the effect of interest rate spread on economic growth in Nigeria, and to investigate the macroeconomic determinants of interest rate spread in the country. It is hoped that the outcome of this study will be of relevance to government policy makers especially the Central Bank in the formulation and implementation of policies designed to address the wide interest rate spread and its effect on the country's economic growth.

For ease of analysis and presentation, the paper is divided into five parts. After this introduction, section 2 gives a highlight of literature review while section 3 dwells on the methodology, featuring model specification and estimation techniques. Sections 4 and 5 contain results of analysis and the conclusion of the study, respectively.

2.0 Literature Review

Many studies have investigated the determinants of interest rate spread in various countries including Nigeria The study by Fofack (2016) which employs two-step wise regression finds that oil rents, foreign direct investment inflows, real GDP growth significantly affect interest rate spread in the CEMAC region. The study by Tennant and Folawewo (n. d.) identifies public sector borrowings as a percentage of total loans, discount rate, inflation rate and reserves as a ratio of deposits as macroeconomic variables that positively affect interest rate spread in low and middle income countries. Akinlo and Owoyemi (2012) find that gross domestic product, reserves requirements, average loans to average total deposit ratio, remuneration to total assets ratio are positively related to interest rate spread, while development stock, treasury certificates, ratio of non-interest income to average total assets negatively relate to interest rate spread in Nigeria. Rebei (2014) avers that monetary policy rates and real GDP growth are macroeconomic factors explaining interest rate spread in Solomon's Island: while increase in bank rate widens interest rate spread and growth of real GDP lowers it in the country. The study by Njeri Ombui and Kagiri (2013) reveals that interest rate spread in Kenya is positively affected by inflation, credit risk, liquidity risk and average return on assets.

Grenade (2007) conducts a trend analysis of data (covering the period from 1993 to 2003) on commercial banks' interest rate spread in Eastern Caribbean Currency Union. Panel data analysis (fixed effect regression) is employed to investigate the determinants of interest rate spread in the Union. The trend analysis reveals that interest rate spread in the Union has been strong and persistent with no sign of narrowing and that interest rate spread of foreign owned banks is larger than that of domestic banks. The panel data analysis identifies high level of market concentration, high operating costs, central bank's regulated savings deposit rate and non-performing loans as factors responsible for the high interest rate spread in the Union.

The determinants of interest rate and interest rate spread of commercial banks in Macedonia are explored in Georgievsca *et al* (2011) study based on fixed effect and feasible generalized least squares estimator. The analysis of panel data on 27 banks cover the period from first quarter of 2001 to second quarter of 2009. The study finds *inter alia* that bank size, differential between domestic and foreign rates and market share are important factors affecting interest rate spread. Increase in bank size and decrease in market share are found to narrow the interest rate spread. Interest rate differential is observed to widen the spread in interest rate.

Were and Wambua (2014) empirically investigate the determinants of banking sector interest rate spread in Kenya using Panel Data Analysis. The study finds that bank specific factors such as bank size, credit risk, return on average assets and operating costs positively affects interest rate spread. It also finds that bank liquidity ratio negatively affects the spread and that bigger banks have higher spread than smaller ones. The effects of macroeconomic factors such as economic growth and monetary policy rate on interest rate spread are observed to be statistically not significant.

Using fixed effect estimator for analysis of panel data, Samahiya and Kaakunga (2014) hold that liquidity, deposit market share and cost efficiency are significant determinants of net interest margin in Namibian commercial banking industry. Deposit market share in that country is observed to reduce net interest margin. Liquidity positively affects net interest margin. Cost efficiency is, however, observed to have a contrary negative sign and this, the researchers attribute to the shift towards non-interest sources of income among commercial banks in the country.

The macroeconomic determinants of interest rate spread in Ghana are investigated using ARDL approach to cointegration and vector error correction analysis in Sherrif and Amoako (2014). The estimated long-run model shows that inflation and total deposit widen interest rate spread while the estimated short-run model shows that treasury bills rate is negatively related to the spread. Further evidence from the short-run model is that inflation and public sector domestic borrowing widen the spread.

The determinants of interest rate spread in Rwanda are also investigated in Rusuhuzwa, Karangwa and Nyalihama (2015) using the Arellano-Bond dynamic panel data generalized method of moments. The empirical evidence indicates that interest rate spread is positively affected by credit risk, operation cost and inflation.

The effect of interest rate spread on economic growth has not received much attention as the determinants of interest rate spread. Thus the empirical literature on effect of interest rate spread has been quite lean.

Gentler, Hubbard and Kashyap (1991) conduct a study on effect of interest rate spread on investment and hence, on output in the United States using the generalized method of moments. The empirical evidence suggests that widening interest rate spread significantly predicts output decline in the country.

Cojocaru, Hoffman and Miller (2012) examine the role of financial development in the economic growth of transition economies of Central and Eastern Europe

(CEE) and Commonwealth and Independent States using the first differenced generalized method of moments estimator. The study finds, amongst others, that high interest rate spread and reduced banking competition hamper economic growth in the countries.

Majanga (2015) employs correlation and regression analyses to study the trend in interest rate spread and its association with economic growth (using real GDP as proxy) in Malawi over the period 2006 to 2014. The study finds strong correlation between interest income and wide interest rate spread. It also finds that wider spread contributes to the malfunctioning of the country's economy.

Saushini and Sheefeni (2016) examines the effect of banking sector interest rate spread on economic growth in Namibia in the period, 1991 through 2013 using various times series analysis techniques (impulse response function, forecast error variance decomposition, etc).The study finds, that the short-run effect of interest rate spread on gross domestic product is positive and significant.

3. Methodology

3.1 Model Specification and Estimation Technique

To achieve its objectives, the paper specifies two models: one to investigate the effect of interest rate spread on economic growth, and the other to investigate the macroeconomic determinants of interest rate spread in the country.

The economic growth effect of interest rate spread is investigated based on a model which augments the Solow growth model by incorporating IRS and relevant growth determinants. The model is specified in its functional form as:

$$RPCYG = f(CGFCF, IRS, HC, TOPEN, INF, EXRT, GFCE) \quad [1]$$

Where RPCYG = Real per capita income growth; CGFCF = Annual growth rate of gross fixed capital formation, HC = Human capital (secondary school enrolment); TOPEN = Trade openness; INF = Inflation, EXRT = Exchange rate; GFCE = Government final consumption expenditure, and IRS = interest rate spread.

Following Tennant and Folawewo (n. d.) and Fofack (2016) the study specifies the model to investigate the macroeconomic determinants of interest rate spread in Nigeria (in its functional form) as:

$$IRS = f(MPR, INF, DDEBT, TBR, CRR) \quad [2]$$

Where IRS = Interest rate spread; MPR = Monetary policy rate; INF = Inflation; DDEBT = Federal government domestic debt; TBR = Treasury bills rate; CRR = Cash reserves ratio

The ARDL approach to cointegration and error correction analysis is employed to investigate the long-run and short-run effects of interest rate spread (and the other control variables) on economic growth, and the long-run and short-run effects of the selected macroeconomic variables on interest rate spread.

The error correction model of equation [1] is specified econometrically as:

$$\Delta \mathrm{RPCYG}_t = a_0 + a_1 \Delta \mathrm{RPCYG}_{t-1} + \sum_{h=0}^{l} (\lambda_h \, \Delta \mathrm{LCGFCF}_{t-i} \;) + \sum_{i=0}^{m} (\beta_i \, \Delta \mathrm{LIRS}_{t-i} \;) + \sum_{j=0}^{n} (\chi_j \, \Delta \mathrm{LHC}_{t-j} \;) + \sum_{k=0}^{P} (\partial_k \, \Delta \mathrm{LTOPEN}_{t-k} \;) + \sum_{l=0}^{q} (\phi_l \, \Delta \mathrm{INF}_{t-l} \;) + \sum_{v=0}^{r} (\pi_v \, \Delta \mathrm{LEXRT}_{t-v} \;) + \sum_{c=0}^{s} (\varphi_c \, \Delta \mathrm{LGFCE}_{t-c} \;) + \Omega \mathrm{ECT}_{t-1} + \mu_t \; [1^*]$$

The associated long-run model is specified as:

$$\mathrm{RPCYG}_t = \beta_0 + \beta_1 \mathrm{CGFCF}_t + \beta_2 \mathrm{LIRS}_t + \beta_3 \mathrm{LHC}_t + \beta_4 \mathrm{LTOPEN}_t + \beta_5 \mathrm{INF}_t + \beta_6 \mathrm{LEXRT}_t + \beta_7 \mathrm{LGFCE}_t + \mu_{1t} \quad [1^{**}]$$

The error correction model of equation [2] is specified econometrically as:

$$\Delta \mathrm{LIRS}_t = a_0 + a_1 \Delta \mathrm{LIRS}_{t-1} + \sum_{h=0}^{l} (a_h \, \Delta \mathrm{LMPR}_{t-i} \;) + \sum_{i=0}^{m} (b_i \, \Delta \mathrm{INF}_{t-i} \;) + \sum_{j=0}^{n} (c_j \, \Delta \mathrm{LDDEBT}_{t-j} \;) + \sum_{k=0}^{P} (d_k \, \Delta \mathrm{LTBR}_{t-k} \;) + \sum_{l=0}^{q} (e_l \, \Delta \mathrm{LCRR}_{t-l} \;) + \varphi \mathrm{ECT}_{t-1} + \varepsilon_t \; [2^*]$$

The associated long-run model is specified as:

$$\mathrm{LIRS} = a_0 + a_1 \mathrm{LMPR} + a_2 \mathrm{INF} + a_3 \mathrm{LDDEBT} + a_4 \mathrm{LTBR} + a_5 \mathrm{LCRR} + \varepsilon_{2t} \quad [2^{**}]$$

The variables are as previously defined. L stands for natural logarithm, Δ is the first-order difference operator, ECT is error correction term included in the models to reconcile the short-run dynamics with the long-run relationship. The coefficients of the error correction terms in the equations (Ω, φ) are expected to be negatively signed and statistically significant to play the role of error correction in the models. μ_t, μ_{1t}, ε_t, ε_{2t} are the error (residual) terms of respective models.

Data for the estimation are sourced mainly from the World Bank's **World Development Indicators** (2015) and Central Bank of Nigeria **Statistical Bulletin** (2015).

3.2 Justification of Included Variables and *A priori* Expectations

Growth Model

Real per capital income growth: This is the dependent variable of the growth model, and has been used copiously to measure economic growth in theory (e.g. Solow growth, the Human-capital augmented growth model) and numerous empirical growth studies.

Growth of gross fixed capital formation: Growth theories identify investment (measured as change in physical capital stock) as a key determinant of economic growth. The theories predict positive relationship between growth and investment. The *a priori* expectation therefore is that investment positively affects growth.

Human capital: The augmented Solow growth theory also referred to as the human capital augmented Solow growth model recognizes the role of human capital in the growth process. Well developed human capital enhances economic growth. The *a priori* expectation is that human capital positively affects economic growth.

Interest Rate Spread: This is the explanatory variable of interest in the specified growth model. We hypothesise that wider spread resulting from high lending interest rate and relatively low deposit interest rate will adversely affect economic growth.

Trade Openness: International trade theories postulate that trade between or among countries enhances growth of the economies of countries participating in it. The New growth theory also recognises the role of trade in economic growth of nations. Thus the *a priori* expectation in respect of the relationship between trade openness and economic growth is that trade openness positively affects growth.

Inflation: High inflation rates adversely affect economic growth as it increases production cost, leading to reduction in output as well as reduction in the productivity of factors of production. Empirical studies (Salami and Kelikume, 2010; Bassey and Onwioduokit, 2011; Bawa and Abdullahi, 2012; Danladi, 2013; Doguwa, 2013) have shown existence of a threshold inflation rate beyond which inflation

adversely affects growth. Below this threshold, inflation could be favourable to growth.

Exchange Rate: Theoretically, increase in the exchange rate (currency depreciation or devaluation) positively affects exports as exportable items become cheaper in foreign markets. It also reduces the demand for imports as imports become quite expensive in the domestic (home) market. These translate into improved balance of trade and enhanced economic growth. The effect of currency depreciation on economic growth transpires if the country is a producing and exporting country. However, if the country is highly dependent on imports, currency depreciation will adversely affect the growth of the economy of the country as it will trigger inflation and volatility of macroeconomic variables which causes much uncertainty with its adverse effects.

Government final consumption expenditure: Government expenditure, if productive, triggers economic activities, leading to economic growth. This is the view of the Ram's growth accounting model of 1986 and the Keynesian aggregate expenditure theory. However, if expenditure results in wastage and is unproductive, it could adversely affect economic growth as it trigger high inflation with its attendant ills.

IRS Model

Interest Rate Spread: This is the dependent variable.

Monetary Policy Rate: This is also referred to as the minimum rediscount rate. It is the rate at which the central bank lends to the commercial banks. It is the benchmark interest rate in Nigeria and a key determinant of the lending interest rate of commercial banks. If this rate is high, lending interest rate would also be high. Therefore, all things being equal, positive relationship exists between the monetary policy rate and interest rate spread.

Inflation: Inflation reduces the value of credit extended by banks. According to the Fisher's equation, real interest rate equals nominal interest rate minus inflation. The real interest rate is zero where inflation equals nominal interest rate. It will be negative where inflation exceeds the nominal interest rate. Thus, inflation reduces the real interest rate. To hedge against the effect of inflation on the real interest rate, banks raise the nominal interest rate charged on loans or credit extended. The increase in nominal interest rate, all things being equal, widens the interest rate spread. Thus positive relationship exists between inflation and interest rate spread.

Government domestic debt: High government domestic borrowing engenders reduction in amount of loans extended to the private sector and drives up the lending interest rate thereby widening the interest rate spread, *ceteris paribus*. Positive relationship therefore exists between government domestic debt and interest rate spread.

Treasury bills rate: Treasure bills are federal government interest-bearing debt instruments with zero risk (being backed up by the government), and short maturity period, usually not exceeding a year. They constitute significant portion of commercial banks liquid assets and are particularly attractive to risk-averse investors. There is no clear-cut relationship between treasury bills rate and interest rate spread. It could be positive or negative. Where commercial banks prefer to lend to the government through the purchase of treasury bills, because of the perception of zero probability of loan repayment default, this would imply a reduction in the amount of credit extended to private sector and the consequence would be increase in the lending interest rate, which also implies increase in the interest rate spread. On the other hand, the commercial banks may pay part of the return on their investment in treasury bills to depositors with longer term deposits through higher deposit interest rate. The increase in deposit interest rate, all things being equal, will engender reduction in the interest rate spread.

Cash reserves ratio: This is the minimum percentage of customers' deposits in commercial banks that the banks are expected to hold as reserves in the form of cash, or to keep (as zero interest bearing) deposits with the central bank. The cash reserves ratio is set by the central bank. The higher the cash reserves ratio, the lower will be the amount of deposit left for lending to the borrowers, and this could engender increase in the lending interest rate in the absence of alternative sources of loans where demand for loan is high. The increase in lending interest rate, all things being equal, implies increase in the interest rate spread. Thus cash reserves ratio is expected to be positively related to interest rate spread, *ceteris paribus*.

4. Results and Discussions

4.1. Analysis of the Growth Model

The results of the unit root test for variables of the economic growth model are presented in Table 1.

Table 1. Unit Root Test Results for Variables of the Growth Model.

Augmented Dickey Fuller Test (ADF)							
Variables	**Levels**			**First Difference**			**Order of Integration**
	ADF test stat	**Test Critical Value (5%)**	**Inference**	**ADF test stat**	**Test Critical Value (5%)**	**Inference**	
RPCYG	-5.320	-3.553	S	-	-	-	I(0)
CGFCF	-2.629	-3.568	NS	-10.614	-3.568	S	I(1)
LOG(IRS)	-2.437	-3.553	NS	-4.074	-3.563	S	I(1)
LOG(HC)	-2.651	-3.558	NS	-4.128	-3.558	S	I(1)
LOG(TOPEN)	0.109	-3.595	NS	-5.537	-3.595	S	I(1)
INF	-3.703	-3.558	S	-	-	-	I(0)
LOG(EXRT)	-0.847	-3.553	NS	-5.346	-3.558	S	I(1)
LOG(GFCE)	-5.029	-3.574	S	-	-	-	I(0)
Phillips-Perron (PP) Test							
Variables	**Levels**			**First Difference**			**Order of Integration**
	PP test stat	**Test Critical Value (5%)**	**Inference**	**PP test stat**	**Test Critical Value (5%)**	**Inference**	
RPCYG	-5.320	-3.553	S	-	-	-	I(0)
CGFCF	-5.313	-3.558	S	-	-	-	I(0)
LOG(IRS)	-2.534	-3.553	NS	-9.917	-3.558	S	I(1)
LOG(HC)	-2.306	-3.553	NS	-3.927	-3.558	S	I(1)
LOG(TOPEN)	-1.839	-3.553	NS	-7.645	-3.558	S	I(0)
INF	-2.635	-3.553	NS	-9.748	-3.558	S	I(1)
LOG(EXRT)	-0.828	-3.553	NS	-6.179	-3.558	S	I(1)
LOG(GFCE)	-2.626	-3.553	NS	-6.317	-3.558	S	I(1)

NS = Non-stationary, S = Stationary

The unit root test results presented in Table 1 indicate that the variables are of mixed order of integration, though most of them are integrated of order 1, that is most of them are stationary at first difference. The existence of long-run relationship between the variables is tested using the ARDL bounds test approach to cointegration. This method of testing for cointegration is preferred to other methods because of the mixed order of integration of the variables. The result of the cointegration test is presented in Table 2. The estimated ARDL model on which the cointegration test, the error correction and long-run growth models are based, is presented in Table A2 in the appendix.

Table 2. Cointegration Test for Variables of the Growth Model (ARDL (Bounds Test) Approach)

Sample: 1983 2014		
Included Observations:32		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	6.50	7
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	1.92	2.89
5%	2.17	3.21
2.5%	2.43	3.51
1%	2.73	3.9

It may be observed in Table 2 that the computed F-statistic is greater than the upper bound critical values at the conventional levels of significance. This is an indication that the variables are cointegrated, implying that a long-run (level) relationship exists between the dependent variable and the explanatory variables. Existence of long-run relationship between the variables implies that the short-run dynamic relationship can be represented with an error correction model. The estimated error correction model and the associated long-run coefficients are presented in Table 3.

Table 3. Estimated Error Correction and Long-Run Growth Model

Dependent variable: RPCYG			
Selected Model: ARDL (1, 1, 1, 2, 2, 0, 1, 2)			
Sample: 1981 to 2014			
Included Observations: 32			
Cointegrating Form			
Variable	Coefficient	t-stat.	Prob
D(CGFCF)	-0.01	-0.31	0.75
DLOG(IRS)	-11.07	-6.29	0.00
DLOG(HC)	88.69	4.37	0.00
DLOG(HC(-1))	-67.28	-3.48	0.00
DLOG(TOPEN)	-7.58	-2.54	0.02
DLOG(TOPEN(-1))	13.76	4.31	0.00
D(INF)	0.34	6.26	0.00
DLOG(EXRT)	-4.72	-2.09	0.06
DLOG(GFCE)	-12.05	-4.18	0.00
DLOG(GFCE(-1))	-17.63	-6.70	0.00

CointEq(-1)	-0.61	-8.52	0.00
R-squared = 0.8098; R-bar-squared = 0.5789; F-stat. = 3.5069, Prob (F-stat.) = 0.0111; DW-stat = 2.1458			
Long Run Coefficients			
CGFCF	0.26	1.50	0.16
LOG(IRS)	-4.68	-0.80	0.44
LOG(HC)	56.63	1.44	0.17
LOG(TOPEN)	-6.27	-0.55	0.59
INF	0.56	1.92	0.08
LOG(EXRT)	4.23	1.88	0.08
LOG(GFCE)	5.27	0.61	0.55
C	-256.72	-1.52	0.15

The results show that the long-run effect of growth in gross fixed capital formation (i.e. investment) on economic growth is positive, though statistically not significant. The positive long-run effect conforms to the predictions of the growth theories. The non-statistical significance suggests that investment in the growth driving-sectors (particularly manufacturing. Health, education and agriculture) of the economy has been inadequate.

The negative sign on the coefficients of interest rate spread variable in the short- and long-run models conforms to *a priori* expectation and implies that wider spread adversely affects economic growth of Nigeria. This is in sync with the findings of previous studies for other countries (Gertler et al, 1991; Cojocaru, 2012; Majanga, 2015). Specifically, a 1% increase in the IRS is associated with 0.11% decrease in the growth rate of real GDP per capita in the short-run in Nigeria. The long-run effect is, however, not statistically significant.

Human capital variable is observed to be positively and significantly related to real GDP per capita contemporaneously in the error correction model. This is in conformity with the augmented Solow growth model (also referred to as the human capital augmented Solow growth model) and underscores the relevance of human capital development in economic growth. However, the relationship between previous levels of secondary school enrolment (proxy for human capital) variable and real GDP per capita is negative and also statistically significant. This suggests that the return on human capital development (in terms of its contribution to economic growth) in Nigeria diminishes after a year. The long-run effect of secondary schooling (proxy for human capital) as seen in the long-run model is statistically not significant, though it is positive.

The effect of trade openness on economic growth is observed to be adverse, contemporaneously. This is a reflection of the import dependence nature of the economy which tends to adversely affect the country's reserve of foreign exchange and the infant industries. However the one-year lagged effect which is positive and statistically significant upholds the argument of the supporters of trade liberalization especially the World Bank and the multinational corporations and other proponents of international trade (Rodrik, 1999). The argument is that trade liberalization or openness is essential for economic growth.

Inflation is observed to be positively related to real per capita income growth in the short- and long- run. The short-run effect is highly significant even at the 1% level, while the long run effect is significant at the 10% level. A 1% increase in inflation rate is associate with 0.34% rise in the growth rate of real GDP per capita in the short-run, while a 1% rise in inflation is associated with 0.56% increase in real per capita income in the long-run. This suggests that inflation rate in the period covered by the study was within the range at which it positively affects growth as several studies have shown that below some threshold, inflation could positively affect economic growth, but beyond it, its effect on growth could be adverse (Salami and Kelikume, 2010; Bassey and Onwioduokit, 2011; Bawa and Abdullahi, 2012; Danladi, 2013; Doguwa, 2013).

Currency depreciation is observed to have adversely affected the growth of Nigeria's economy within the period under review in the short-run. This could be attributed to the adverse effect of currency depreciation on investment (domestic and foreign) and trade in a less developed economy like Nigeria in the short-run. The effect is significant at the 6% level. The estimated coefficient indicates that 1% increase in the nominal ₦/$ exchange rate is associated with approximately 0.05% decrease in the growth rate of the economy in the short-run. However, the long-run effect is positive and significant at the 10% level. The long-run coefficient shows that a 1% persistent (or sustained) rise in the exchange rate engenders 0.04% increase in the growth rate of the economy.

The short-run effect of government final consumption expenditure on real per capita income is observed to be negative and significant contemporaneously and even with a lag. This is an indication that government consumption expenditure within the period had been unproductive, and consequently failed to stimulate the economy as expected.

The error correction term (CointEq(-1)) in the error correction model is negatively signed as expected. It is statistically significant and its absolute value lies between zero and 1. The coefficient which measures the speed of adjustment of economic growth to its equilibrium level in the event of short-run deviation from the

equilibrium indicates that 61% of the short-run deviation from equilibrium is offset by short-run adjustments annually to restore the equilibrium. This is a fairly high speed of adjustment.

The diagnostic statistics reveals that the model has a high goodness of fit as indicated by the coefficient of determination which shows that nearly 81% of the systematic variation in the dependent variable is explained by the regressors. The F-statistic of 3.5069 with p-value of 0.01105 passes the test of statistical significance at the 2.5% level, indicating that the explanatory variables are jointly significant in the determination of the dependent variable. The Durbin-Watson (DW) statistic of 2.1458 indicates absence of first order positive autocorrelation in the model.

4.1.1. Test of Structural Stability for the Growth Model

The stability of the model was tested using the plots of the CUSUM and CUSUMSQ. The plots are presented in Figures 2A and 2B.

Figure 2A. Plot of CUSUM for the Growth Model

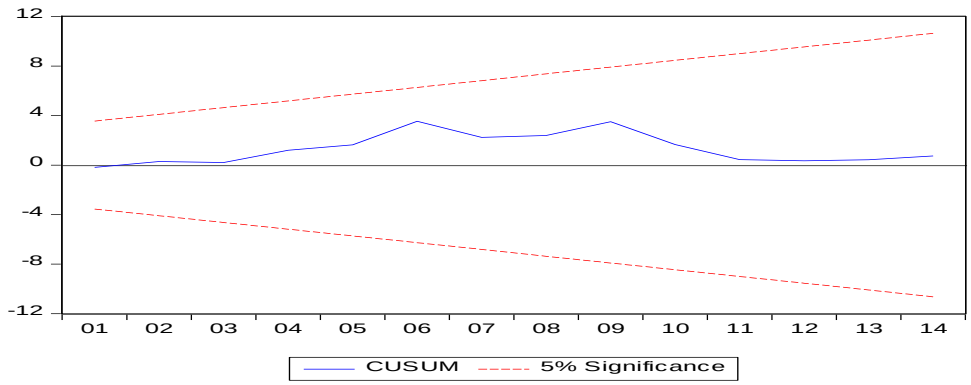
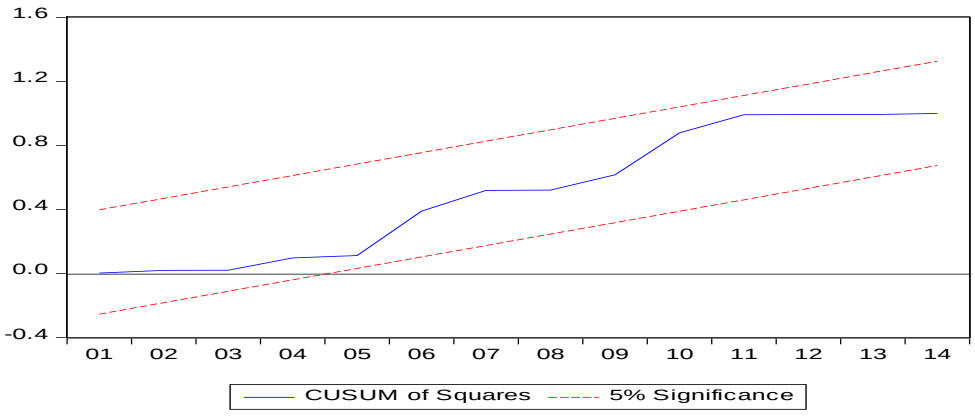


Figure 2B. Plot of CUSUMSQ for the Growth Model



We observe that for the growth model, both plots lie between the 5% critical bounds. This indicates that the model is stable and can therefore be reliably deployed for policy purposes.

4.2. Analysis of Interest Rate Spread Model

The results of the unit root tests for variables used for estimation of the IRS model are presented in Table 4. The tests were conducted using the ADF test and complemented with the Phillips-Perron test.

Table 4. Unit Root Test Result for Variables of the IRS Model

Augmented Dickey Fuller Test (ADF)							
Variables	**Levels**			**First Difference**			**Order of Integration**
	ADF test stat	**Test Critical Value (5%)**	**Inference**	**ADF test stat**	**Test Critical Value (5%)**	**Inference**	
LOG(IRS)	-2.437	-3.553	NS	-4.074	-3.563	S	I(1)
LOG(MPR)	-2.857	-3.553	NS	-6.610	-3.558	S	I(1)
INF	-3.703	-3.558	S	-	-	-	I(0)
LOG(DDEBT)	-1.405	-3.553	NS	-4.380	-3.558	S	I(1)
LOG(TBR)	-2.771	-3.553	NS	-6.264	-3.558	S	I(1)
LOG(CRR)	-2.099	-3.553	NS	-3.374	-3.225*	S	I(1)
Phillips-Perron (PP) Test							
Variables	**Levels**			**First Difference**			**Order of Integration**
	PP test stat	**Test Critical Value (5%)**	**Inference**	**PP test stat**	**Test Critical Value (5%)**	**Inference**	
LOG(IRS)	-2.534	-3.553	NS	-9.917	-3.558	S	I(1)
LOG(MPR)	-2.801	-3.553	NS	-6.637	-3.558	S	I(1)
INF	-2.635	-3.553	NS	-9.748	-3.558	S	I(1)
LOG(DDEBT)	-1.658	-3.553	NS	-4.368	-3.558	S	I(1)
LOG(TBR)	-2.741	-3.553	NS	-6.412	-3.558	S	I(1)
LOG(CRR)	-2.268	-3.553	NS	-4.716	-3.558	S	I(1)

*= 10% level, NS = Non-stationary, S = Stationary

The results indicate that the variables are of mixed order of integration as some are integrated of order zero (i. e. stationary at levels) and others integrated of order 1 (stationary at first difference). The mixed order of integration of the variables suggests the use of ARDL (Bounds) test to test for cointegration. The result of the test is presented in Table 5. The estimated ARDL model on which the cointegration test, the error correction and long run IRS models are based, is presented in Table A2 in the appendix.

Table 5. Cointegration Test for Variables of the IRS Model (Bounds Test Approach)

Sample: 1983 2014		
Included Observations:32		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	3.94	5
Critical Value Bounds		
Significance	Upper Bound	Lower Bound
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73

The result of the cointegration test indicates that the null hypothesis of no long-run relationship is rejected at the 2.5%, 5% and 10% levels as the computed F-statistic is greater than the upper bounds critical values at these levels of significance. Existence of long-run relationship between the variables implies that the short-run (dynamic) relationship can be represented with an error correction model (ECM). The results of estimations of the ECM and the associated long-run coefficients are presented in Table 6.

Table 6. Estimated Error Correction and Long Run IRS Model

Dependent variable: LOG(IRS)			
Selected Model: ARDL (1, 1, 0, 1, 1, 2)			
Sample: 1981 to 2014			
Included Observations: 32			
Cointegrating Form			
Variable	Coefficient	t-stat.	Prob
DLOG(MPR)	0.30	0.56	0.58
D(INF)	0.01	2.19	0.04
DLOG(DDEBT)	0.93	3.26	0.00
DLOG(TBR)	-0.40	-1.09	0.29
DLOG(CRR)	0.92	4.95	0.00
DLOG(CRR(-1))	0.32	2.10	0.05
CointEq(-1)	-0.75	-5.46	0.00
R-squared = 0.8747; R-bar-squared = 0.7634; F-stat. = 10.0931, Prob (F-stat.) = 0.0000; DW-stat = 2.3801			
Long Run Coefficients			
LOG(MPR)	4.22	2.74	0.01
INF	0.01	1.81	0.09
LOG(DDEBT)	0.17	2.08	0.05
LOG(TBR)	-3.32	-2.47	0.02
LOG(CRR)	0.38	1.87	0.08
C	-3.11	2.60	0.02

The result shows that monetary policy rate, inflation, government domestic debt and cash reserves ratio are positively related to IRS. Increase in these variables engenders higher (wider) interest rate spread in Nigeria. These findings conform to *a priori* expectations.

The effect of monetary policy rate on IRS is significant only in the long-run (at the 2.5% level). The estimated long-run coefficient indicates that 1% persistent rise in the MPR could engender 4.2% rise in the IRS.

The effects of inflation, domestic debt and cash reserves ratio are significant in both the long- and short-run. The short-run effect of inflation on IRS is significant at the 5% level while the long-run effect is significant at the 10% level. A unit (1%) rise in inflation is associated with 1% increase in IRS in the short-run. The effect of 1% persistent rise in inflation on IRS (as seen in the long-run model) is same as in the short-run.

The short-run effect of government domestic borrowing on IRS is highly significant even at the 1% level, while the long-run effect is significant at the 5% level. A 10% increase in government domestic debt is associated with 9.3% increase in the IRS. A 10% sustained increase in government domestic debt is associated with 1.7% increase in IRS as seen in the long-run model.

The short-run effect (contemporaneous and lagged effects) and the long-run effect of CRR on IRS are significant at the conventional levels. A 1% increase in the cash reserves ratio by the central bank engenders increase in IRS by 0.92% in the short-run contemporaneously. In the long-run, a 1% increase in the cash reserves ratio is associated with 0.38% increase in IRS.

Treasury bills rate is negatively signed in both long-run and short-run models, though the coefficient is only significant in the long-run model (at the 2.5% level). The negative relationship between treasury bills rate and commercial bank interest rate spread indicates that higher treasure bills rate engenders narrowing of the IRS. Considering that the spread could be narrowed either by increasing the deposit interest rate or by reducing the lending interest rate or both, increase in the TBR could have engendered any of these. Here, the result probably suggests that since treasury bills constitute part of the short-run investment (assets) of commercial banks as it is a zero-risk asset with guaranteed returns, being backed up by the government, and considering that the funds used by the commercial banks in investing in treasury bills are mainly from customers' deposits, the banks may therefore wish to *share* the interest earned on investment in treasury bills with the depositors by way of higher deposit rate. This probably explains why commercial banks in Nigeria pay higher interest on longer term

deposits (that is, deposits from which withdrawals are not made during longer periods (usually one year or more)). The higher deposit rate resulting from increase in treasury bills rate, all things being equal, engenders narrowing of the IRS in the long-run. The long-run coefficient indicates that 1% sustained increase in the TBR is associated with 3.3% decrease in the IRS, and this effect is significant even at the 2.5% level. The observation of a negative relationship between treasury bills rate and IRS in Nigeria is in sync with the finding of Sherrif and Amoako (2014) in Ghana.

The error correction term is negatively signed and statistically significant as expected. The absolute value of the coefficient lies between zero and 1 and suggests that 75% of disequilibrium in the system is offset by short-run adjustment annually to restore equilibrium. This is a high speed of adjustment to equilibrium.

An examination of the diagnostic statistics reveals that the model has a high goodness of fit as indicated by the coefficient of determination (R-squared) which shows that nearly 85% of the systematic variation in the dependent variable is explained by the regressors. The F-statistic of 10.0931 with p-value of 0.0000 easily passes the test of statistical significance even at the 1% level and indicates that the explanatory variables are jointly significant in the determination of the dependent variable. The DW-statistic shows that the model is not plagued with the problem of first order positive autocorrelation.

4.2.1. Model Stability Test for IRS Model

The stability of a model enhances its reliability for policy. The structural stability of the model was tested using the plots of CUSUM and CUSUMSQ. The plots are presented in Figure 3A and Figure 3B respectively.

Figure 3A. Plot of CUSUM for IRS Model

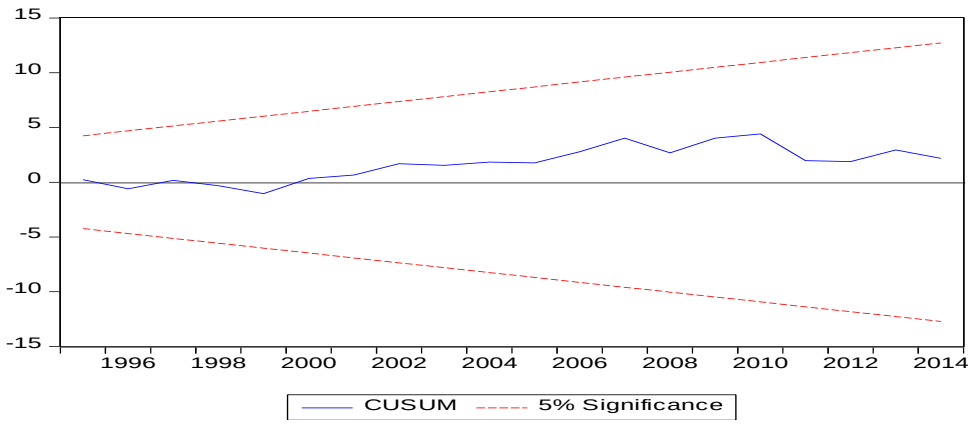
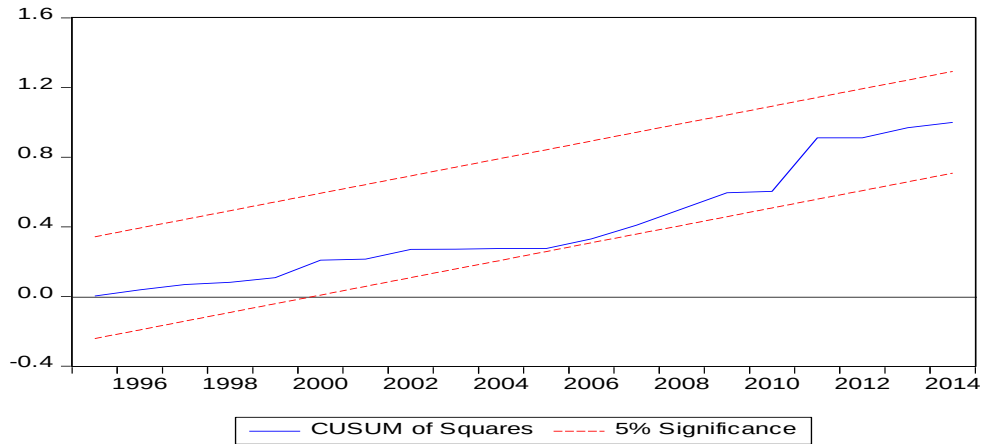


Figure 3B. Plot of CUSUMSQ for IRS Model



The figures show that the plots of CUSUM and CUSUMSQ lie between the 5% critical bounds. This is an indication that the model is stable.

5. Conclusion and Recommendations

The paper has investigated the economic growth effect and determinants of interest rate spread in Nigeria using data that spans the period from 1981 to 2014. The ARDL bounds test approach to cointegration and error correction were utilized for the investigation. The study finds adverse short-run and long-run effects of higher interest rate spread on economic growth in the country, though the long-run effect is statistically not significant. On the determinants of interest rate spread, it finds monetary policy rate, inflation government domestic debt, cash reserves ratio and treasury bills rate to be key factors. While higher monetary policy rate, inflation, government domestic debt and cash reserves ratio are found to widen the spread, higher treasury bills rate narrows it.

In view of the finding that higher interest rate spread adversely affects economic growth in the country, policies aimed at reducing (or narrowing) the spread should be formulated and implemented. Based on the empirical evidence from the estimated IRS model, the following are recommended for policy considerations:

- The observation that monetary policy rate is found to be positively and significantly related to interest rate spread in the long-run calls for reduction or lowering of the monetary policy rate by the Central Bank of Nigeria. This would translate into reduction in lending rate and narrowing of the IRS which would enhance the growth rate of the economy.

- Considering that inflation is found to be positively related to IRS, the Central Bank should intensify efforts towards reduction of inflation (below the threshold) in the country as this would help reduce the IRS. The reduction in IRS achieved through reduction in inflation will help boost the growth of the nation's economy.

- There is need for the government to make conscious and deliberate effort to reduce domestic borrowing as this has the tendency to crowd out private sector investment as a result of the increase in lending interest rate and widening of the interest rate spread it engenders.

- The observation of positive relationship between cash reserves ratio and IRS calls for reduction of the cash reserves ratio set for commercial banks by the central bank. This would enhance the capacity of banks to lend at lower interest rate, thereby reducing the IRS.

- The observation that higher treasury bills rate is associated with lower IRS in the long-run calls for increase in the treasury bills rate.

The above results and recommendations, however, are tentative, having regard to the use of proxies for some of the variables and the model specification that does not provide for possible parameter shift from events such as the Structural Adjustment Programme of 1986 – 1990 and the global economic crisis of 2008 – 9. Even so, with the proven existence of long-run relationship between the variables and hugely acceptable goodness of fit statistics, including the high explanatory power of the regressions, the study has considerable merit and its conclusion cannot be nullified.

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APPENDIX

Table A1. Estimated ARDL Model of Economic Growth

Dependent Variable: RPCYG
Method: ARDL
Date: 12/21/16 Time: 04:54
Sample (adjusted): 1983 2014
Included observations: 32 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): CGFCF LOG(IRS2) LOG(HC) LOG(TOPEN) INF LOG(EXRT) LOG(GFCE)
Fixed regressors: C
Number of models evalulated: 4374
Selected Model: ARDL(1, 1, 1, 2, 2, 0, 1, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RPCYG(-1)	0.385191	0.189262	2.035219	0.0612
CGFCF	-0.008195	0.050429	-0.162512	0.8732
CGFCF(-1)	0.168111	0.054342	3.093605	0.0079
LOG(IRS2)	-11.06582	3.142745	-3.521069	0.0034
LOG(IRS2(-1))	8.189297	2.685242	3.049743	0.0087
LOG(HC)	88.70908	33.17645	2.673857	0.0182
LOG(HC(-1))	-121.1353	43.04528	-2.814137	0.0138
LOG(HC(-2))	67.24159	27.72422	2.425373	0.0294
LOG(TOPEN)	-7.577554	4.111883	-1.842843	0.0866
LOG(TOPEN(-1))	17.47815	4.991711	3.501434	0.0035
LOG(TOPEN(-2))	-13.75725	6.370494	-2.159526	0.0486
INF	0.344113	0.096429	3.568579	0.0031
LOG(EXRT)	-4.716145	4.008866	-1.176429	0.2590
LOG(EXRT(-1))	7.316634	4.171344	1.754023	0.1013
LOG(GFCE)	-12.04485	4.088722	-2.945871	0.0106
LOG(GFCE(-1))	-2.345197	4.704168	-0.498536	0.6258
LOG(GFCE(-2))	17.62850	4.883520	3.609793	0.0028
C	-157.8328	85.02151	-1.856387	0.0846

R-squared	0.809827	Mean dependent var	1.716444
Adjusted R-squared	0.578904	S.D. dependent var	7.163382
S.E. of regression	4.648458	Akaike info criterion	6.209270
Sum squared resid	302.5143	Schwarz criterion	7.033746
Log likelihood	-81.34831	Hannan-Quinn criter.	6.482560
F-statistic	3.506903	Durbin-Watson stat	2.145842
Prob(F-statistic)	0.011054		

*Note: p-values and any subsequent tests do not account for model selection.

Table A2. Estimated ARDL Model of IRS

Dependent Variable: LOG(IRS2)
Method: ARDL
Date: 12/20/16 Time: 09:49
Sample (adjusted): 1983 2014
Included observations: 32 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LOG(MPR) INF LOG(DDEBT) LOG(TBR) LOG(CRR)
Fixed regressors: C
Number of models evalulated: 486
Selected Model: ARDL(1, 1, 0, 1, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(IRS2(-1))	0.247170	0.178826	1.382178	0.1822
LOG(MPR)	0.298840	0.753075	0.396826	0.6957
LOG(MPR(-1))	2.874468	0.948658	3.030036	0.0066
INF	0.008592	0.004627	1.857069	0.0781
LOG(DDEBT)	0.935480	0.567939	1.647150	0.1152
LOG(DDEBT(-1))	-0.808060	0.548765	-1.472508	0.1564
LOG(TBR)	-0.398565	0.535130	-0.744802	0.4651
LOG(TBR(-1))	-2.102045	0.741875	-2.833423	0.0103
LOG(CRR)	0.924500	0.284970	3.244201	0.0041
LOG(CRR(-1))	-0.313298	0.240294	-1.303813	0.2071
LOG(CRR(-2))	-0.321538	0.200913	-1.600381	0.1252
C	-2.344524	1.026482	-2.284037	0.0334

R-squared	0.847357	Mean dependent var	1.641004
Adjusted R-squared	0.763403	S.D. dependent var	0.818520
S.E. of regression	0.398138	Akaike info criterion	1.275961
Sum squared resid	3.170279	Schwarz criterion	1.825612
Log likelihood	-8.415374	Hannan-Quinn criter.	1.458155
F-statistic	10.09314	Durbin-Watson stat	2.380057
Prob(F-statistic)	0.000006		

*Note: p-values and any subsequent tests do not account for model selection.

GDP REBASING AND IMPLICATIONS FOR MONETARY FOR MONETARY POLICY IN NIGERIA

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1. INTRODUCTION

Gross domestic product (GDP) remains the *mother of all economic indicators and the most important statistic or barometer of the economy's ups and downs.* Forecasters analyse it for hints on where the economy is heading. Monetary managers study it to refine their investment strategies or view it as a report card on performance of their policies etc. Subject to certain limitations, higher growths of real GDP are generally believed to enhance the welfare of individuals, as all things being equal, economic growth precipitates higher average incomes and a higher level of consumption, and consequently a higher standard of living. The reverse is true with negative real GDP growth.

The arguments for regular GDP rebasing are predicated on its numerous benefits to the rebasing economy. It enables policy makers and analysts access to accurate and reliable economic statistics that are crucially important for evidence-based decision-making in the macroeconomic management process. Second, GDP rebasing brings to the fore a true reflection of the size and structure of the economy as the economy evolves by incorporating new economic activities which were previously not captured in the computational framework. This obviously enables governments the required tools to tackle the challenges of growing the economy and fighting poverty`. In addition to Governments having a better understanding of the structure of the economy and the sectoral growth drivers, GDP rebasing helps to identify sectors where investment and resources should be channeled in order to grow the economy, create jobs, improve infrastructure and reduce poverty.

Nigeria undertook its GDP rebasing exercise in April 2014. The National Bureau of Statistics announced the outcomes of a rebasing exercise of Nigeria's GDP from 1990 to 2010 base year. This indicates a substantial base lag of 20 years, in

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apparent disregard for the United Nations Statistical commission's recommendation that GDP be rebased after every 5 years.

The outcome indicates a phenomenal 89 percent increase in Nigeria's GDP from USD 270 billion to USD 510 billion as at the year 2013. The increase is reflected to the emergence of new sectors such as telecommunications, Nollywood and retail activities which were hitherto underreported or excluded out-right from GDP computations. With this outcome, Nigeria is now enviably the largest economy in Africa and 26 largest in the world.

The rebased estimates reflect the changing structure of the Nigerian economy with the gradual diversification of the economy away from both hydro carbons and agriculture since 1990. As highlighted in Table 2 below, the services sector has been the largest gainer, with its share of GDP in 2010 more than doubling from 23.6% to 50.2% after the rebasing exercise. In contrast, the industrial sector was the greatest loser, with its contribution to GDP falling from 46.1% to 25.8%. Similarly, the contribution of agriculture also witnessed a reduction from 30.3% to 24%.

After this introduction, the rest of the paper is presented as follows: Sections 2 and 3 contain analysis of the theoretical framework and a review of empirical literature, respectively. Section 4 features the theoretical model and empirical analysis. Section 5 concludes the paper.

2.0 Theoretical Framework

The theoretical construct that links output and money over long periods of time is the quantity theory of money. The theory, based on the classic work of Fisher (1911), states that changes in the quantity of money result in, other things being equal, approximately equal changes in the price level. It is always expressed as an identity with MV=PY, where M is money supply; V represents velocity of money in circulation, implying the average number of transactions that a unit of money performs at a specified interval of time; P is the general price level while Y is the final output. As an identity, the MV which is the total expenditure in the economy is identical to total receipts derived from the sale of final goods and services, PY. The identity is transformed into a behavioural relation when V and Y are held constant.

Basically the quantity theory of money holds that there is a direct relationship between prices, income, and the amount of money circulating in the economy. It was first propounded by French philosopher Jean Bodin (1530–1596), who observed that the large amounts of gold and silver being brought back from the

New World were driving up prices across Europe. Further support to this observation was given by two British philosophers, John Locke (1632–1704) and David Hume (1711–1776). They note that when the quantity of money grows, so does purchasing power and economic activity. In their view, if a government wanted to lower prices to combat inflation, based on quantity theory, all it has to do is decrease the amount of money in circulation. When this is done, less amount of money will be available to consumers to spend; there will be a fall in demand as well as prices. This theory remained valid for next two centuries with other economists elaborating on the basic interconnection between the quantity of money, income, and prices. Until the 1930s, it remained the dominant theory for explaining inflation, deflation, and the nature of business cycles.

Furthermore, the quantity theory was developed as a response to the influx of precious metals in Europe in the sixteenth century. The writings of the mercantilist economists and others marked the origin of the theoretical arguments that highlight the link between money and prices. According to this view, a case of equilibrium can occur with expansion in M (for example if there is a discovery of new gold mines) that would result in some entrepreneurs becoming richer with associated rise in demand and their rising demand bringing about increases in the prices of products. This rise in price will increase the income of some other group of entrepreneurs whose demand would also increase the price level even further and the trend will continue. However, at some point, this trend will die out with the restoration of equilibrium somewhere at a higher price level. Rather than developing their ideas into a theory of value, mercantilists explain it mechanically or by way of the operation of competition.

Contrary to Hume and other Mercantilists' view, the classical economists developed the quantity theory of money into a component of their theory of value and distribution. They invoke Say's Law of markets which takes output as given and assume V also as given being that it is determined by customs of payment and institutional arrangement of society. Thus, proportional changes in M will be reflected in P and vice versa. But David Ricardo (1772-1923) kicks against the usual causal relationship of the quantity theory of money and rather maintains that those changes in P lead to changes in M and not the other way around. This thinking sees value of gold (money) as a numeraire for all other prices. Thus, if the quantity of money becomes more abundant as a result of a rise in productivity of gold mines brought about by more discovery of new gold mines or technological change, it will imply that the price of gold falls and accordingly, gold price falls and thus, all other commodities' price rise. On the other hand, with increase in total output, the subsequent scarcity of money brings about a rise in price beyond the normal level resulting in excess profit in gold production. This will result in supply

expansion that will reduce the price of gold to its normal level and thereby restoring equilibrium but at a higher price level. Therefore, it is the normal price of gold that actually determines the quantity of money in circulation. The major difference between Ricardo and the mercantilists is that the direction of causation is from P to M and, thus, the quantity of money is endogenously determined. This implies that it is determined within the economic system.

The neoclassical economists continue writing on the quantity theory of money with the issue of exogeneity dominating the work of Irving Fisher (1867-1947). The Fisher equation of exchange of 1911 states that MV = PT, meaning that the total transactions at the current price level is equal to the total money stock multiplied by how often it is turned over. Also, Knut Wicksell (1851-1926) emphasizes the endogenous character of the money supply as being responsible for variations in the price level. The coming of Keynesian economics, however, renders the quantity theory of money less important and used only for determining nominal magnitudes of real variables.

In the thinking of Keynesian analysts, quantity of money can not in any way directly affect the real economy but only indirectly through variations in the interest rate. However, a characteristically contrasting view has been articulated by economists from the Chicago school, led by Milton Friedman (1912-2006). Milton claim that money matters and is responsible for every economic phenomenon. In Friedman's view every economic episodes in US economic history from the great depression of the 1930s to the inflation of the 1970s have explanations from variations in money supply. The appearance of stagflation in the 1960s and rejection of Phillips curve are considered a blow to Keynesian economics and these issues have facilitated the emergence and acceptance of monetarism and its establishment as a separate school of economic thought with great appeal. Apart from showing the inadequacy of Keynesian economics in dealing with stagflation, Friedman proposes an explanation hinged on natural rate of employment. He maintains that an expansionary economic policy only affects the economy in the short run as the economy, in the long run, returns to the natural rate of unemployment at a higher rate of inflation.

The quantity theory of money is expressed in growth rates by Friedman and the monetarists, implying that they take as given in the beginning, the velocity of money in circulation. Therefore, the growth rate of money supply influences the nominal growth rate which is identified with nominal gross domestic product (GDP) i.e. the product of the real GDP times the general price level. With the introduction of the notion of natural unemployment by Friedman, the argument is that in the long run, at least, the real GDP is equal to full employment GDP,

which corresponds to the level of natural unemployment and thus, the growth rate of GDP is known in the long run. Subsequently, the long run growth rate of money supply when it exceeds the growth rate of real GDP, raises the growth rate of the price level which is the rate of inflation.

In the view of Keynesians, the velocity of money is associated with high volatility; thus changes in money supply can be absorbed by changes in the velocity of money with negligible effects either on output or on the price level. The foregoing arguments stress that velocity of money is a function of consumer and business spending impulses, which cannot be constant. This same view is shared by neoclassical economists, especially in the case of the economy being in the liquidity trap in which case despite changes in money supply, the real economy is not affected at all. In this case, changes in money supply are absorbed by corresponding changes in velocity of money. Also, the effect of supply of money on prices may work indirectly through variations in interest rates that may in turn have effects on aggregate demand.

3.0 Empirical Literature

The empirical evidence of quantity theory of money in the literature has been mixed and depend on the definitions accorded money supply (narrow or broad) and the time period. For instance the velocity of the narrow money supply V1=GDP/M1, for the U.S. economy has shown a rising trend from 1920-1929, a falling trend from 1929-1946 and an upward trend from 1947-1981, erratic behavior along a falling trend from 1981-1991 and an upward trend since then.

Jiang et al (2015) provide a fresh new insight into the dynamic relationship between money growth and inflation in China by applying a novel wavelet analysis. Their findings show strong but not homogenous links between money growth and inflation in the mid-1990s and the period since the early 2000s. The paper conclude for China that the long-run relationship between M0 growth and inflation supports the modern quantity theory of money (QTM), while the medium-run relationship between M1 growth and inflation as well as M2 growth and inflation supports the modern QTM. In the opinion of the paper, it fits well with the fact that China has experienced economic transitions and structural adjustments in monetary policy over the past two decades.

Sabade (2013) writing on whether money supply is the cause of inflation in India, an alternative postulate to understanding inflation, maintains as do other economists and policymakers that 'inflation is always a monetary phenomenon'. According to him, the theory holds in countries which have reached the full

employment level, but in developing and underdeveloped countries this may not always be true, as advanced countries facing severe recession try to bring about inflation by raising money supply, and other advanced countries with high inflation pressure are able to successfully curtail inflation by reducing money supply. However, according to Sabade (ibid), the entire inflation dynamics playing out in developing economies are different and it's necessary to re-visit and re-examine the relevance of the belief that inflation is always a monetary phenomenon, especially with respect to developing economies. Basically, he attempts to test the validity of the quantity theory of money in Indian situation and provide an alternative postulate.

Subramanian (1999), is of the view that the quantity theory brings forth a direct and proportional relationship between the quantity of money and the price level. This relationship was developed in the classical equilibrium framework by two alternative but equivalent expressions. The first referred to as "equation of exchange" is attributable to Irving Fisher while the second called "Cambridge approach or cash balance approach" is credited to A.C. Pigou of Cambridge University. The two versions are mainly focused on money as a means of exchange, and produce models of transaction demand for money. The institutional details of payment mechanism is the concern of Fisher (1911) in his analysis while the focus of Cambridge economists is for holding money by individuals.

Saatcioglu and Korap (2008) examine the long-run relationship between monetary aggregates, prices and real output level based on the quantity theory of money perspective for the Turkish economy. The study uses contemporaneous econometric techniques and its findings show that stationary characteristics of the velocities of narrow and broad monetary aggregates cannot be rejected. Further findings by the authors indicate that monetary aggregates seem to have an endogeneity characteristic for the long-run evolution of prices and real income as such, the paper concludes that monetary authority follows an accommodative monetary policy during the review period.

In their paper on the applicability of quantity theory of money in the case of Pakistan: a time series analysis, Farooq et al (2015) aim at a dynamic investigation of the validity of quantity theory of money. Using annual data from 1961-2010, the paper conducts stationarity analysis involving unit root test and finds that all the variables adopted for the study are stationary at level. The paper also carries out Engle Granger pairwise causality test to determine the direction of causal relationship between money stock growth and the rate of inflation. The results of analysis reveal the existence of long-run positive relationship between the two

variables with the direction running from growth in money stock to the rate of inflation.

Chuba (2015) assesses the relevance of the quantity theory of money in Nigeria by estimating a recursive vector auto-regression (VAR) model with data from first quarter 2000 to fourth quarter 2013. Much in sync with the quantity theory of money, the paper finds that the price level is directly and significantly related with money supply but the change in the price level is not proportional to the change in money supply. Consequently, the paper concludes that monetary expansion is the main causal factor in the persistent increase in the price level in Nigeria.

Nwafor rt al (2007) investigate the quantity theory of money via Keynesian liquidity preference theory in a developing economy of Nigeria over the sample period, 1986Q3 to 2005Q4. The study applies the ADF unit root and Johansen-Juselius cointegration tests and finds a long run relationship among aggregate demand for money (seasonally adjusted M2), real income, real interest rate, and expected inflation rate. It concludes that the stability of M2 is deemed necessary as a monetary policy tool to effect economic activity in Nigeria.

Writing on the quantity theory of money and its long run implications: empirical evidence from Nigeria, Alimi (2012) sees quantity theory of money as one of the popular classical macroeconomic models that explain the relationship between the quantity of money in an economy and the level of prices of goods and services. The paper investigates this relationship for Nigeria economy over the period of 1960 to 2009. It uses Johanson cointegration method and causality test to respectively confirm the long run relationship among the relevant variables and a unidirectional causal relationship running from money supply to inflation which provides evidence in support for monetarist"s view. Finally, the paper confirms the proposition of quantity theory of money that inflation is a monetary phenomenon.

Patuti and Tatulescu (2013) describe quantity theory of money as one of the most important theoretical propositions in monetary economic theory although a great many economists contest its validity. The Paper argues that the variation in the consumer price index (CPI) in Romania in the last six years can be fully explained by the variation in money supply.

4.0 Model and Empirical Analysis

4.1 Theoretical Model and Framework

The relationship between gross domestic product and money supply has been extensively discussed and explored in the literature. Many of those studies such as Liang and Huang (2011) establish the existence of a relationship between them. However, understanding this relationship involve a review of economic thought which dates back to the mercantilist era. The mercantilist addresses this relationship through the quantity theory of money that links changes in the amount of money with the general price level of the economy. Tomas (1830) is credited as the writer who first suggested that an increase in the amount of the precious metal would lead to an increase in domestic prices relative to prices of other countries. However, other economists such as John Locke (1691), David Hume (1752), David Ricardo (1880), and John Stuart Mill (1848) have reformulated the traditional relationship between money and prices and maintain that prices and money in circulation change at the same rate. The quantity theory of money is built on a direct and proportional relationship between money and the general price level in an economy. It is developed in the classical equilibrium framework by two alternative but equivalent expressions. The first is the "equation of exchange" by Irving Fisher of Yale University and the second is the 'Cambridge Approach or Cash Balance Approach" by the Cambridge University economists spearheaded by A. C. Pigou. The two versions are particularly concerned with money as a means of exchange which yields models of transaction demand.

The possibility of using M2 to target the growth rate of nominal gross domestic product has been discussed by Feldstein and Stock (1994). They are of the view that the Federal Reserve can make use of M2 to reduce long-term average inflation rate and the variance of annual GDP growth rate. In their theoretical analysis Liang and Huang (2011) focus on the open market operations as the most commonly used instrument of monetary policy. It is based on the idea of adjusting money supply in the market with economic output and consequently altering towards particular directions. The impact on the economy as a result of change in money supply is analyzed by using the IS-LM curve and AD-AS curve from the prospective of macroeconomics. The paper also explains two approaches of the transmission of monetary policy's impact on output as well as adopting Keynesian structural model approach, in the money market. Also, the paper quoting Frederic S (2007), on the traditional Keynesian structural model examines the channels of interest rate effects through which the monetary policy eventually impacts on aggregate demand. Further attempts have been made by researchers after the Keynesians, to pursue a much more detailed structural

model approach by viewing the monetary transmission mechanism through various channels.

Generally, the position of the monetarists is that money plays an active role in the economy and leads to changes in income and prices. In other words, changes in the money stock bring about changes in income and prices in an economy and hence, the direction of causation runs from money to income and prices without any feedback, i.e., unidirectional causation.

In their analysis, the Keynesians are of the view that money does not play an active role in changing income and prices. They maintain that changes in income result in changes in money stocks through demand for money with the implication that the direction of causation runs from income to money without any feedback. Also, changes in prices are mainly caused by structural factors. While there is disagreement among economists on the role of money, income and prices as well as their interrelationship, these variables are considered important and a large amount of literature is devoted to them.

Specifically, an active area of empirical work after the provocative paper by Sims (1972) has been on the causal relationships between money and income and between money and prices. Focusing on Granger causality, Sims develops a test of causality for United States data to examine the causal relationship between money and income. He finds evidence of unidirectional causality from money to income as claimed by the Monetarists. In their paper, Lee and Li (1983) examine causality among money, income, and prices in Singapore and find bidirectional causality between income and money and unidirectional from money to prices. Other studies such as Joshi and Joshi (1985) find bidirectional causality between money and income in Indian economy; Khan and Siddiqui (1990) establish unidirectional causality from income to money and bidirectional between money and prices in Pakistan. In carrying out causality test between money and income for Asian countries, Abbas (1991) establishes bidirectional causality in Pakistan, Malaysia and Thailand. Herwartz and Reimers (2006) in a panel based paper also try to analyse the dynamic relationships between money, real output and prices for an unbalanced panel of 110 economies and find that particularly for high inflation countries homogeneity between prices and money cannot be rejected.

The exposition on the relationship between the quantity of goods and services produced in the economy and money can be traced to early work on the quantity theory of money by the classical economists in the nineteenth and early twentieth centuries. The most explicit of the classical quantity theory is found in the seminal work of Fisher (1911). The quantity theory is basically an exposition on

how the nominal value of aggregate income is determined. Its most important feature is the notion that interest rates have no effect on the demand for money and hence on aggregate income determination.

Fisher's equation of exchange identity relates nominal value of aggregate income to the quantity of money and velocity; as follows:

$M \times V = P \times Y$ (1)

Equation (1) states that the quantity of money multiplied by velocity of money (the number of times that this money is spent in a given year) must equal nominal income (or the total nominal amount spent on goods and services in that year). Fisher notes that given the sluggish pace of institutional and technological transformation which could impact on velocity of money, velocity is normally reasonably stable or constant in the short term. Hence, equation (1) can be written as:

$$PY = M\bar{V} \quad (2)$$

This also states that nominal income (spending) is determined solely by movement in the quantity of money (m). Conversely, demand for money is driven solely by the nominal income.

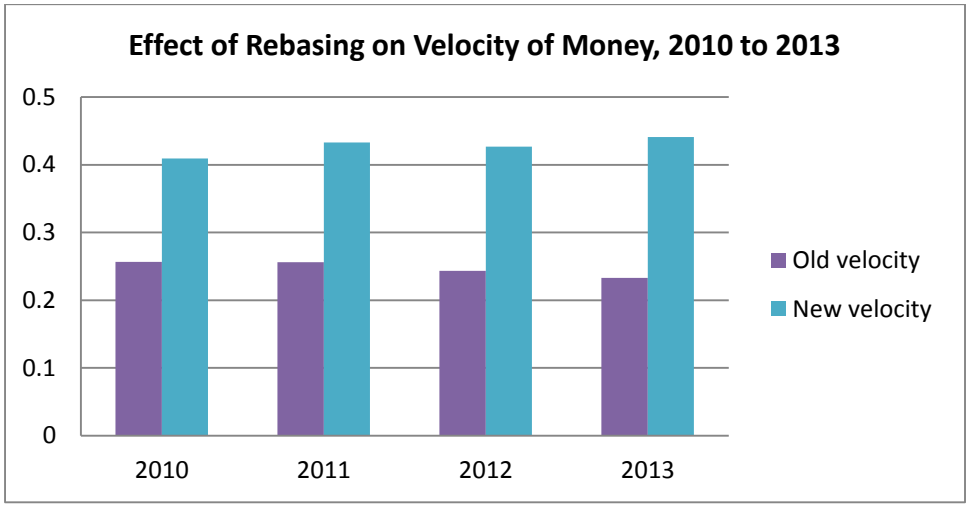
$M^d = kPY$ where $k = I/V$. (3)

Therefore, the Fisherian Theory of demand for money states that demand for money is determined purely by the nominal income in the short run. In the long-run, k is no longer constant and other factors become relevant in explanation of money demand. Focusing on the short run, the monetary policy implication of the rebasing exercise can be inferred. All things equal; demand for money is a constant proportion of the nominal income:

$K = M^d/PY$

Rebasing is synonymous with increase in nominal income. From the quantity theory identity: a partial equilibrium analysis posits that an increase in nominal income leads to one of the following – an increase in demand for money while holding velocity constant and increase in velocity while holding money demand constant. Chart 1 shows the effect of the rebasing of GDP on the velocity of money. As can be seen, the new velocity is higher than the velocity before the rebasing exercise.

Chart 1



The Fisherian equation of exchange also tells what would happen to price if the money supply is unchanged and nominal income is rebased.

Recall that
$Py = MV$
Assuming velocity is constant, then
$kPY = M$
$kP = M/Y$
A change in Y holding M and k constant will decrease P.

The liquidity preference theory propagated by Keynes and his followers presents a different perspective of the demand for money. Focusing on the value of money in terms of what money can buy and the three different motivations for holding money balances, Keynes specifies the following demand for money or liquidity preference function:
$M^d/P = L(i, Y)$ $L_i < 0$ and $L_Y > 0$.
In the equation above, demand for real money balances is positively related to real income but negatively related to the nominal interest rate. In the Keynesian theories of money demand, interest rate plays a role in the determination of the velocity of money, because interest rate is negatively related to demand for money. It also determines the velocity of money. Recall that
$V = PY/M$
At equilibrium, $M^s = M^d$; in the Keynesian theory, $M^d = PL(i, Y)$; therefore,
$V = PY/M = PY/L(i, Y)$

When interest rate rises, L(i, Y) declines and therefore velocity of money will rise. Thus, the constancy of velocity no long holds even in the Keynesian short run analysis. Related to the Keynesian theory is the so-called Portfolio theories attributed to Milton Friedman, which also emphasized importance of other factors such as payment technology, wealth, riskiness of other assets, inflation risk and liquidity of other assets in the demand for money function (Mishkin, 2013).

4.2 Empirical Analysis and Results

Empirically, if the concerns about the impact of the rebased GDP on monetary policy is grounded in fact, it would be expected to see a significant difference in the coefficients of the determinants of the demand for money. Concretely, elasticity of money demand with respect to output should either decrease or increase significantly. To examine this contention, the study uses conventional model of demand for money in which money supply is assumed equal to money demand. The demand for money is explained by two factors, the scale variable, output or GDP, and the opportunity cost variable, the rate of interest. In this experiment, interest rate is proxied by prime lending rate (PLR), maximum lending rate (MLR) and saving rate (SR). Output on the hand is the gross domestic product before (1990 constant prices) and after (2010 constant prices) the rebasing exercise. Though obviously imperfect this experiment will yield a snapshot and intuitive view of the likely impact of GDP rebasing on the monetary aggregates. Results are in Table 1 below.

Table 1: Regression Results – Money demand function

variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	12.088 (6.332)	1.599 (0.300)	10.279 (4.083)	-4.614 (-0.909)	10.540 (5.101)	-3.095 (-0.677)
MLR	0.055 (2.210)	0.036 (1.505)				
PLR			0.009 (0.239)	0.019 (0.648)		
SR					0.039 (0.669)	0.029 (0.614)
GDP(90)	0.244 (1.375)		0.485 (2.672)		0.471 (2.800)	
GDP(10)		0.844 (2.454)		1.253 (4.241)		1.177 (4.247)
R^2	0.540	0.640	0.371	0.591	0.389	0.589
R^2 Adjusted	0.470	0.585	0.274	0.528	0.295	0.526
F-statistic	7.658	11.588	3.835	9.401	4.144	9.350
Observation	16	16	16	16	16	16

Source: Authors' computation

As can be observed from all the columns, the opportunity cost variable is not significant in the determination of the demand for money. Three variants of interest rates are used for the exercise and in all cases, except in model 1, interest rate is statistically not significant. Conversely, the crucial variable, GDP, is statistically significant in all the models, exception of model 1. In columns 2 and 3, maximum lending rate is used as proxy for opportunity cost variable together with GDP at 1990 constant prices and GDP at 2010 constant prices (rebased GDP) in models 1 and 2, respectively. In model 1 GDP at 1990 constant prices in not statistically significant though correctly signed. However, in model 2, GDP at 2010 constant prices is both statistically significant and correctly signed. In terms of magnitude, the coefficient or elasticity of output is also greater in model 2 than in model 1.

In columns 4 and 5, a similar exercise is performed using prime lending rate as proxy for interest rate. Again, the coefficient of the interest rate variable is both incorrectly signed and statistically insignificant in models 3 and 4, respectively. It is crucial to note that GDP at 1990 constant prices in model 3 and GDP at 2010 constant prices in model 4, are both correctly signed and statistically significant. However, observe also that the magnitude of elasticity of GDP is greater in model 4 than in model 3. The implication of this result is that GDP rebasing has increased the elasticity of money demand with respect to output. The responsiveness of money demand to output has increased more than before the rebasing.

In the last two columns, the experiment is repeated with saving rate as proxy for interest rate. Again, in both models 5 and 6, the coefficient of the interest rate is wrongly signed and statistically insignificant, but output variable, GDP at 1990 constant prices and GDP at 2010 constant prices, is statistically significant. The important lesson from these results again is that the magnitude of the coefficient of the GDP at 1990 constant prices is less than the value of the coefficient of GDP at 2010 constant prices. The implication of these results for the economy is that greater demand for money is required to match the new level of GDP. Therefore, the benchmarks for monetary aggregates before the rebasing exercise had been hitherto understated and needs to be revised to capture the larger level of GDP revealed by the rebasing exercise.

The trend analysis of the actual reserve money and benchmark further supports this finding (Charts 2 and 3). In chart 2, the actual reserve money is above benchmark for half of the period, 2005Q1-2015Q4. In most quarters, actual reserve money exceeds the benchmark. In Chart 3, actual broad money supply is consistently above target level of broad money supply until 2009. However, from 2009 strict measures are adopted to keep broad money supply within the

benchmark to check inflation and ensure a stable economic growth. Thereafter, broad money supply was short of targeted level except in 2011.

Chart 2

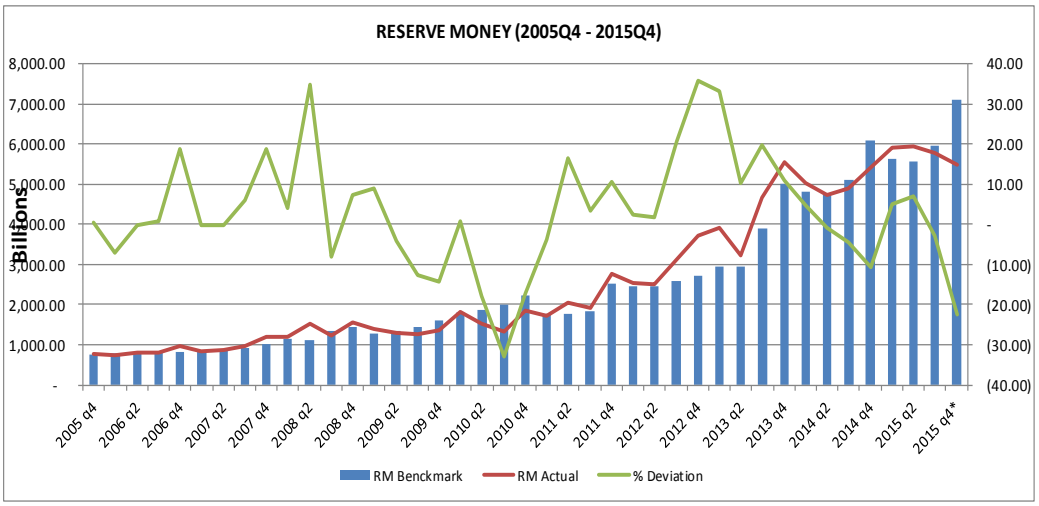
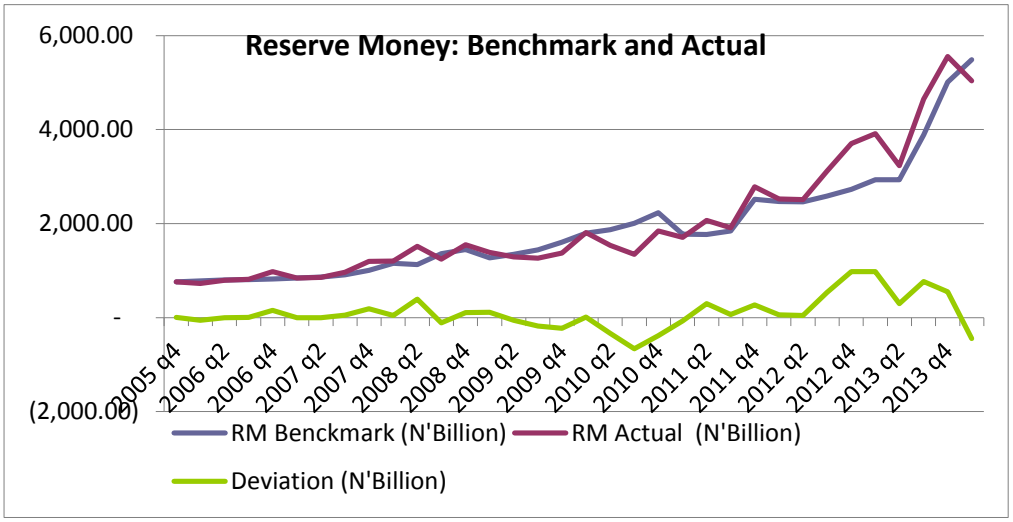


Chart 3



It is important to observe that although economy-wide liquidity was in shortage, there was excess liquidity in the banking sector. Chart 4 shows the steady rise in DMBs'utilization of special deposit facility from 2010 to 2014. In Chart 5, DMBs excess reserves and the money market rates are presented. The high money market rates are used to mop up liquidity from the public. Hence, monetary aggregate outcomes are below their targets between 2009 and 2015 except for 2011 as shown in Table 2. Given the reluctance of DMBs to lend to the public, actual broad money is short of the benchmark.

Chart 4: Special Deposit Facility

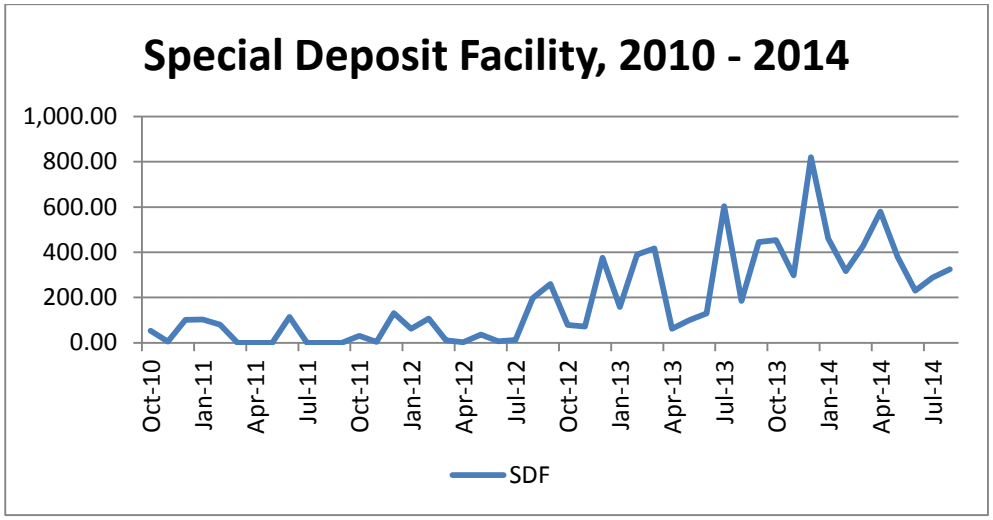


Chart 5: Money Market Rates and Banking System Liquidity

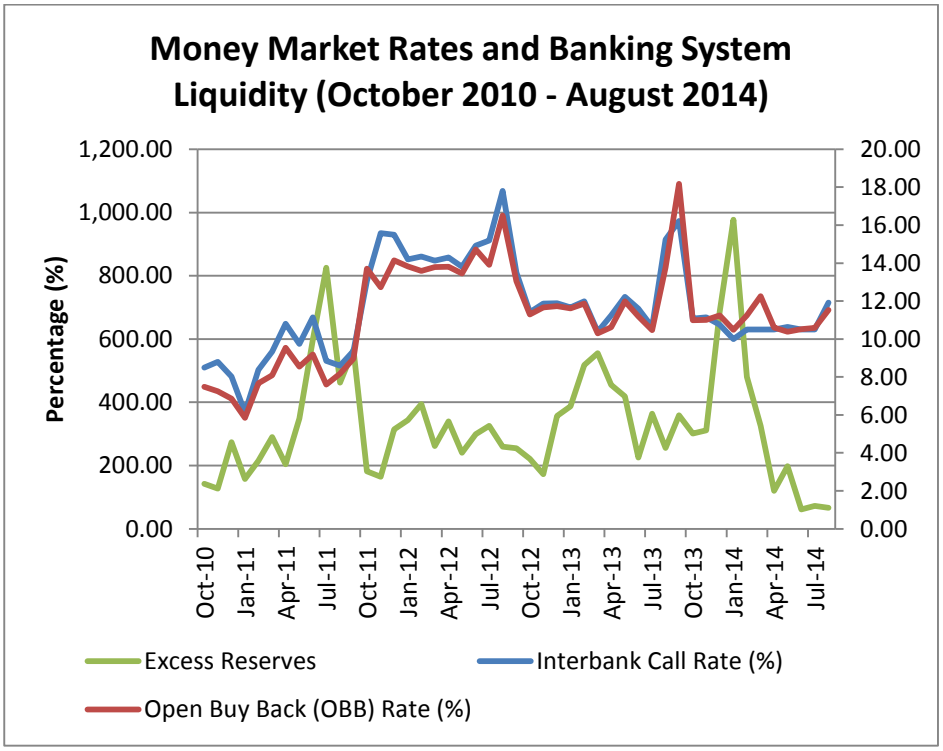


Table 2: Monetary Policy Targets and Outcome, 2009-2015 (per cent).

	Growth in Broad Money		Growth in Narrow Money		Growth in bank Credit to Private sector	
	Target	Outcome	Target	Outcome	Target	Outcome
2009	20.8	17.07	32.23	3.3	44.9	26.8
2010	29.25	6.91	22.36	11	31.54	-3.81
2011	13.75	15.4	15.75	21.49	29.09	44.3
2012	24.64	16.4	34.71	9.6	47.5	6.8
2013	15.2	1.2	17.44	-5.5	17.52	8.96
2014	15.02	16.62	16.23	7.23	23.07	8.74
2015	15.24	7.21	9.91	-5.75	26.06	8.64

5.0 Conclusion

The GDP rebasing has revealed a changing structure of the Nigerian economy with the gradual diversification of the economy away from both hydro carbons and agriculture since 1990. This portends implications for the conduct of monetary policy in Nigeria, and the study sets out to determine this.

The important lesson from the empirical analysis is that the magnitude of the coefficient of the GDP at 1990 constant prices is less than the value of the coefficient of GDP at 2010 constant prices. The implication of these results is that the economic activities should be stimulated to ensure that the deviations between money supply target and actual are narrowed. This will further ensure that money supply consistent with the desired level of economic activity provided at any given period is non-inflationary.

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FINANCIAL POLICY AND MONETARY POLICY IN NIGERIA: A TEST OF THE HYPOTHESIS OF FINANCIAL DOMINANCE

Messrs Tule M. K and Udoh E. A. P[1]

Abstract

The 2007/2008 financial crisis drew attention to a potential form of policy dominance, the demand for and active pursuit of, stability of the financial system - financial dominance. The crisis shows that financial dominance arises when the central bank actively takes measures to ensure the stability of the financial system as its primary objective. This paper examines financial policy in Nigeria using financial and monetary data for the period 2007M01 to 2016M05. Results from the bootstrap rolling window causality test show that financial dominance was only observed during the periods December 2011 through August 2012. This period corresponds to the era when strong macro-prudential policies were introduced to address the problems of the banking sector, liquidity surge from AMCON intervention and continued concerns about the quality of banks' asset. During this period, the CRR was increased significantly from around 1 percent in January 2011 to 12 percent by October 2011. Nevertheless, the independence of the two policies in other sub-periods calls for strong coordination of financial and monetary policies to attain efficient outcome in management of monetary policy and achievement of financial system stability.

Keywords: monetary policy, financial stability policy, financial dominance.

JEL Classification: E61, E52, G01.

1. INTRODUCTION

The financial crisis of 2008 and 2009 and its aftermath have stimulated debates in the literature on the causes of the crisis and ways to prevent its reoccurrence. Central to these debates are the respective roles of monetary and financial stability policies as culprits in the crisis. The major lesson from these debates is that the failures of financial stability, as opposed to monetary policy caused the crisis, suggesting the need to improve the conduct of financial stability to attenuate the effects of future crisis.

The foregoing has spurred initiatives on the part of policy makers to institute policy positions to ensure the simultaneous achievement of the monetary stability and financial stability objectives. While monetary policy aims at stabilizing both

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inflation around the inflation target and resource utilization around a sustainable level, financial stability policy has the objective of maintaining and promoting financial stability, defined as a situation in which the financial system can fulfill its main functions of transforming saving into financing, and providing risk management with sufficient resilience to disruptions that threaten these functions. One of the main innovations in this regard has been the establishment of a macro-prudential instruments/policies targeted at reducing systemic risks to financial stability to complement monetary policy in the management of the macro economy.

Authors including Kok, et al (2014), Bruno (2015) and Cerutti (2015) have highlighted the lack of clear consensus on the implementation and effectiveness of macro prudential policies, its optimal interactions with monetary policy, as well as the synergies and potential trade-offs between the two policy toolkits. Two dissenting viewpoints can be identified in this regard. Bean, et al (2010) and Svensson (2012) present examples of opinions advocating the preservation of the pre-crisis price stability policy-oriented framework, which keeps the two policy functions, i.e., monetary stability and financial stability, largely separate. The alternative viewpoint advocates the merging of the monetary policy and macro prudential policy objectives. The proponents of this viewpoint are cited in Brunnermeier and Sannikov (2013). However, given the lessons learnt from experiences of the financial crisis, the former viewpoint has clearly been invalidated, but while it lends credence to the latter, that is, the merger, the question of the optimal mix between the two remains unanswered, due largely to still limited practical experience with macro-prudential policies across advanced and emerging economies.

These issues are very relevant for Nigeria, as the Central Bank of Nigeria (CBN), like other central banks, in response to the financial crisis, took major steps towards addressing the threat of systemic risk through the adoption and implementation of macro-prudential policy. Amongst these steps has been the creation of the Financial Policy and Regulation Department (FPRD) with a key responsibility for macro-prudential implementation and regulation. The Bank, in addition to focusing on individual banks' micro-ratios, now computes macro-ratios of the industry in order to arrest any emerging systemic risk in the industry. The Bank also conducts stress test on the banks twice yearly, to determine the vulnerabilities that could lead to systemic risk and disruption of financial markets.

Attempts have been made in the literature to figure out the interdependence between monetary policy and the key instruments of financial stability, namely

macro-prudential tool[2]. The transmission mechanism and effectiveness of this policy/relationship are still not fully understood in the literature in spite of the stream of both empirical and theoretical studies in the post global financial crises era. Inspired by the emerging literature, this study seeks to blaze the trail in examining the relationship between financial dominance and monetary policy in Nigeria. The rest of the paper is organized in five sections. Section 2 presents the financial stability policy in Nigeria and highlights its objectives, institutional framework and key instruments used. Section 3 deals with empirical and theoretical literature while section 4 describes the methodology adopted. Section 5 discusses the empirical results. Finally, some concluding remarks and suggestions for further study are summarized in section 6.

2.0 Literature Review

2.1 Models of Financial Dominance

Traditionally, monetary policy is preoccupied with management of the value, availability and cost of credit. Under the gold standard, nominal anchoring (availability) was virtually neglected as central banks were more concerned with their role as the bankers' bank and lender of last resort. The avoidance of financial frictions and bank panics as well as management of deposit money bank (DMB) reserves to ensure convertibility of bank money into standard commodity were paramount functions of central banks at this time. The collapse of the gold standard coupled with the broad sweep of the theory of currency convertibility and the first great inflation of the 1920s spurt concerns and new considerations of the questions of nominal anchoring (Bordo, 1999). Undoubtedly, the policy context shifted in favour of greater pessimism about the private sector and more optimism about government under the Keynesian theory.

After the 1970s, greater advances in monetary theory were recorded. In addition, optimism about government waned while optimism about the ability of the market to efficiently allocate resource waxed stronger. The attention of policy makers and scholars shifted in favour of containing government inefficiencies and developing strong institutions to stop politicians from engaging in short sighted time inconsistent policies that could exacerbate inflation. This thinking emerged largely due to the worsening of the fiscal positions of many countries in the 1970s and 1980s. Under this circumstance, it became imperative to restrain government from mismanaging public finances through independence of the central banks. The monetary authority was relieved of the responsibility for

[2] The important studies are discussed in the literature review following this section.

unemployment and cyclical fluctuations, ushering in the era of great moderation; when the monetary authorities played a dominant role in stabilizing inflation with the hope that it would yield non-inflationary growth (Stock and Watson, 2002; Giannone, Lenza and Reichlin, 2008).

The events of the first decade of the 21st century, however, pointed to new ideas in the theory of monetary policy. The era of fiscal dominance in the 1970s and 1980s revealed the importance of the solvency of governments. However, the monetary policy's dominance of the 1990s obliterated any consideration about the solvency of the private sector and more particularly, of the banking system at the time. However, the global financial crisis of 2007-2008 forced a rethink of existing monetary policy frameworks and objectives. It was realized that macroeconomic stability required fiscal, price and financial stability. The experience of the global economy during the period showed that while price stability was necessary, it was not a sufficient condition for financial and fiscal stability, but a web of interrelationships between price, fiscal and financial stability. It was realized that financial instability could exert negative feedback effects and hinder the price stability objective.

On the other hand, financial stability could help in creating a sound financial system as well as enhance the effectiveness of the monetary policy transmission mechanism. These are essential elements for efficiently achieving the monetary authorities' primary goal of price stability.

Consequently, the crisis led to the introduction of macro-prudential policies underpinned by the thinking that financial stability requires systemic regulation. The understanding is that macro-prudential policies boost the resilience of the financial system and diminish the possibility of a systemic risk and minimize the need for unconventional monetary policy to address market failure and its implications for the central bank's balance sheet.

Interestingly, the relationship between monetary and financial policies hinges on the impact of one policy on the objective of the other. For instance, monetary policy actions such as a change in interest rate or unconventional liquidity injection are capable of increasing risk taking ex-ante and affecting credit constraint ex-post. During a crisis, the central bank's efforts at managing liquidity may save the banking sector from the crisis but may diminish the drive for banks to recapitalize and restructure. It may also encourage weak supervision and regulatory forbearance leading to unwarranted build up in non-performing loans. On the other hand, changing macro-prudential policies are capable of altering the financing conditions, with impact on the real economy and price stability that

monetary policy targets. Coordination of both monetary policy and macro-prudential policies is therefore, critical to avoid a conflict.

2.2 Frameworks of Monetary Policy and Financial System Stability

Smets (2014) systematically categorizes the relationship between price stability and financial stability under three broad frameworks: Leaning against the wind Vindicated, modified Jackson Hole consensus and Financial stability is price stability. Under the first framework, monetary authority should focus on the narrow mandate of price stability while macro-prudential policy which deals with financial stability should be the concerns of a separate authority. The monetary authorities could pursue the mandate of price stability using any of the popular frameworks preferably the inflation targeting framework with an eye on the influence of financial factors on developments in the economy and the monetary policy transmission process.

This view is built around the notion that there is limited interface between the instruments of monetary and macro-prudential policies. It is assumed that there is a clear line of distinction between the instruments, objectives and transmission mechanisms of the two spheres of policy. It is argued that the stance of monetary policy does not contribute in a significant manner to the build-up of imbalances before a crisis. In addition, the main policy instrument of monetary policy, the short run interest rate is considered ineffective in dealing with imbalances in contrast to macro-prudential policy.

The basic analytical framework for this view is provided in Collard, Dellas, Diba and Loisel (2012) whose study characterized the **joint optimal setting** of monetary policy and macro-prudential policies. The connection between monetary policy and financial stability is loose. The framework assumes that banks take excessive risk through their loan policy because they are limited liability entities and the amount of loan granted does not directly reveal the risk-taken. Monetary policy can only deal with the value, volume/cost of credit created but not with the risk. Macro-prudential policies, in contrast, like increasing the capital basis can deal with the systemic risk posed by the excessive credit creating tendency of banks.

The second framework, **leaning against the Wind**, contends that the narrow focus of most central banks on relatively short term inflation objective prevents them from vigorous pursuit of financial stability objective. It acknowledges the existence of a financial cycle that interacts in a nonlinear way with the business cycle and cannot be fully addressed by macro-prudential policies. It admits that the stance of monetary policy may affect the risk taking behavior of financial intermediaries. Conversely, fragility of the financial system may also impinge on

the process of monetary policy transmission and price stability. This framework treats the stability of the financial system as the secondary objective of monetary policy and posits that the policy horizon should be extended since the financial cycle is typically longer than the business cycle (Drehmann, Borio and Tsatsaronis, 2012). It cautions that price stability may not guarantee financial stability hence monetary policy tightening by central banks against the emergence of financial instability may be advisable (Rajan, 2005; Issing (2011) and Trichet, 2010). It suggests a variation of flexible inflation targeting to permit consideration of financial stability in deciding on the optimal path of inflation.

The basic model of analysis was developed by Woodford (2012) and Curdia and Woodford (2012). In the model, the presence of financial frictions is captured in the conventional loss function and accounted for in the optimal targeting rule for monetary policy. The usual loss function of the monetary authorities is adjusted to account for output gap, inflation expectations gap and the marginal risk of a crisis in the financial system. The main implication of the model is that the monetary authorities may consider it appropriate in the short run to allow inflation and output gap to be at levels considered sub-optimal in the medium term just for the sake of dealing with risk of financial instability. Fahr et al (2013) estimate a model with financial frictions for the euro area and demonstrate that adjusting monetary policy to address the risk of financial instability may shift the trade-off of price and output gap stability and enhance overall macroeconomic performance.

The third and final view posits that the two policy spheres are highly interconnected and inseparable. In this view, various instruments are used by the monetary authorities to stabilize the financial system and address the financial market inefficiencies with the view to enhancing the efficiency of the monetary transmission process. This approach underscores the problem of time inconsistency implied in the interaction between monetary and financial policies as well as the importance of proper coordination of monetary policy with financial stability policy to avoid the threat of financial dominance. The basic model is the I(intermediation)-theory of money by Brunnermeier and Sannikov (2013). In the exact words of Brunnermeier and Sannikov (2013):

> "… the i-theory of money… argues that price, financial and fiscal stabilities are intertwined due to financial frictions. In downturns, optimal monetary policy should identify and unlock balance sheet impairments that obstruct the flow of funds to productive parts of the economy. In upturns, diligence is required to avoid imbalances that make the economy vulnerable to liquidity and deflationary spirals".

2.3 Empirical Review

Sequel to the recent financial crisis, which highlighted the need for a "macro-prudential policy" to ensure financial stability, the empirical literature on the relationship between monetary and financial stabilization policies has experienced a boom. A number of these studies have adopted DSGE model in addressing the issue. A large proportion of the studies adopted a closed economy model while a few others used small open economy and monetary union models [see for example, Rabanal and Quint (2014) and Brzoza-Brzezina, Kolasa, and Makarski (2013) for monetary Union and Medina and Roldós (2013) and Unsal (2013) for a small open economy].

The authors have also differed on the choice of modeling the financial friction in their studies. Quite a couple of the models attributed financial friction to collateral constraint (Brzoza-Brzezina, Kolasa, and Makarski (2013), Carrasco-Gallego and Rubio (2013), Gelain, Lansing, and Mendicino (2013) and Lambertini, Mendicino and Punzi (2013)) while others have adopted Bernanke, Gertler and Gilchrist (1999) approach of financial accelerator (Benes and Kumhof (2011), Kannan, Rabanal and Scott (2012), Rabanal and Quint (2014), Suh, 2013; and Unsal(2013)). Other sources of financial friction modeled in the literature include bank runs (Angelini and Faia (2013)), moral hazard (Collard, Dellas, Diba and Loisel (2013)) and costly liquidation (Medina and Roldós (2013)).

Another key area of distinction among the models is whether or not they include financial sector and housing sector. Several of the studies explicitly modeled the financial sector as part of the economic system (Angelini and Faia (2013), Brzoza-Brzezina, Kolasa, and Makarski (2013), Collard, Dellas, Diba and Loisel (2013) and Roldós (2013), Rabanal and Quint (2014) and Unsal (2013)). The real estate sector appears to be quite vital to financial stability. Historically, most financial crises spring from the housing sector. For instance, excessive credit to the real estate sector led to the buildup of financial fragility in USA and Euro area and eventual collapse of the global economy in 2007-2008. This pattern is similar to the Scandinavian and Japanese crises of the early 1990s (Smets, 2012; Pill and Smets, 2013). Thus, real estate sector is a key feature in most of the studies (see for instance, Angelini, Neri, and Panetta (2011), Brzoza-Brzezina, Kolasa, and Makarski (2013), Carrasco-Gallego and Rubio (2013), Gelain, Lambertini, Mendicino and Punzi (2013), Lansing and Mendicino (2013), Rabanal and Quint (2014)).

Finally, the choice of macro-prudential instrument is a major distinguishing factor among the studies. Basically, four macro-prudential instruments have been widely acknowledged in the studies: capital adequacy requirement (CAR), loan to income (LTI) ratio, loan to value (LTV) ratio and short-cut (SC). Majority of the

studies adopted CAR, though at times complemented with other instruments such as LTV (see Angelini and Faia (2013), Brzoza-Brzezina, Kolasa, and Makarski (2013), Collard, Dellas, Diba and Loisel (2013)). Others adopted short cut (Bailliu, Meh and Zhang (2012), Kannan, Rabanal and Scott (2012), Rabanal and Quint (2014), Suh (2013) and Unsal (2013)) and few adopted LTV only (Beau, Clerc, and Mojon (2012), Carrasco-Gallego and Rubio (2013), Lambertini, Mendicino and Punzi (2013), and Gelain, Lansing, and Mendicino (2013)).

In terms of empirical findings and results for useful policy analysis, Carre, Couppey-Soubeyran and Dehmej (2014) perform a comprehensive meta-analysis of 18 DSGE models that specify the policy mix between monetary policy and macro-prudential policy. The key element of these studies is the incorporation of macro-prudential policies, particularly in form of rules to limit financial instability into the augmented Taylor rule, which adjusts the interest rate to the inflation gap, the output gap and a financial gap.

In the meta-analysis, the response to financial gap in the augmented Taylor rule is taken to be the dependent variable. Its value is assumed to represent the policy mix between monetary policy and macro-prudential policy. The higher the value of the response coefficient, the more the two policies are 'integrated' in order to jointly achieve the financial stability objective. In this case, monetary policy can aid macro-prudential policy in its financial stability goal and may sometimes even lead to a situation of financial dominance, where excessive importance is attached to financial stability to the detriment of monetary stability and macroeconomic stability.

Conversely, the lower the values of the response coefficient, the more these two policies are 'separated' from each other. In this case, monetary policy will remain focused on monetary stability and macroeconomic stability, while macro-prudential policies focus on financial stability. Their results indicate that the type of macro-prudential instruments significantly determines the choice of the policy mix between monetary policy and macro-prudential policy. In addition, their results show that the policy mix is more separated when the monetary policy rule gives greater focus or weight to inflation. On the other hand, the results show that when less importance is given to inflation in the monetary policy rule, monetary policy and macro-prudential policy will be more integrated and may potentially result in a situation where monetary policy is subordinated to macro-prudential policy, in which case monetary policy lose dominance to financial policy (Carre et al, 2014).

Brunnermeier and Sannikov (2014) take the argument for integrated policy mix further by developing a potential conceptual framework, i-theory of money, for

analyzing monetary developments in the ECB. This framework assumes that risk is endogenous to the system and risk premia vary with time. Both risk and risk premia can, however, be mitigated through the implementation of appropriate monetary and macro-prudential policies. This framework assumes that price stability, financial stability and fiscal stability are intertwined and difficult to separate.

However, Lewis and Roth (2015) take a more moderate approach on the interaction between monetary policy and financial stability. Their view is that monetary policy may be influenced by the stance of macro-prudential policy and where macro-prudential tools appear ineffective in ensuring financial stability, monetary policy should be adjusted to account for financial stability concerns. They show that when macro-prudential policy is too lax and the financial sector does not absorb losses to a sufficient degree, monetary policy may be forced to become too accommodating so as to reduce private sector debt and shore up bank balance sheets. In other words, financial system stability tends to dominate monetary policy and monetary dominance surrenders to financial dominance under this context.

3. Financial Stability Policy in Nigeria: Objectives, instruments and Institutional Framework

Macro-prudential policy became more prominent as a framework for financial system stability in the aftermath of the global financial crisis in 2007-2008. The development that followed the financial crises resulted in tepid financial conditions and exchange rate depreciation across emerging and developing countries like Nigeria.

The crisis revealed that market discipline, regulation and supervision of financial institutions, markets and infrastructure alone could not prevent systemic risk. Macro-prudential regulation may also be needed to prevent a buildup of systemic risks and mitigate its effect on the real economy as well as hold more and higher quality capital, liquidity requirement, credit creation, risk weights, infrastructure requirements and supervisory intensity.

A review of country experiences revealed a key feature of macro-prudential policy to be dynamic and not static. It must move in synchronization with the perceived systemic risk at a specific period. In Nigeria, concerns over bank liquidity and the quality of bank assets' deterioration motivated the first set of macro-prudential policies implemented between 2008 and 2010. The main tools used were: limits to DMBs' lending to capital market, decrease in cash reserves

requirement, liquidity ratio, and foreign exchange positions. Between 2010 and 2015, new challenges emerged including the following:

I. Ongoing resolution of the problems in the banking sector;

II. Expected increment in government spending in the run up to April 2011 and 2015 elections,

III. liquidity surges from AMCON interventions

IV. Continuous concerns over quality of banks' assets

V. Strong speculative demand pressures in the foreign exchange market.

To tackle these challenges, the central bank of Nigeria, which combines the role of a monetary authority and bank regulator rolled out the following policies amongst others: Guarantee of foreign credit lines (2010-2011), increase CRR from 1% to 2% (February 2011), to 4 per cent (June 2011), to 8 percent (October 2011) and then to 12% (July 2012). In 2015, the CRR was revised and separate rates were imposed on private and public sector deposits; that is, public sector 70 per cent and private sector 25 percent. The rates were, however, merged in November 2015 to 31 percent following the full implementation of the Treasury Single Account (TSA). On the other hand, liquidity ratio increased from 25 percent to 30 percent in March 2011.

In the first half of 2015, US dollar appreciated against most emerging market currencies, as a result of declining energy prices, turbulence in financial markets, sluggish resurgence of advanced economies and the effect of USA monetary policy normalization. These developments increased volatility of capital flow and heralded financial system vulnerabilities in emerging markets. Specific to Nigeria was the need to save the financial market from the damaging consequences of persistent pressure on the naira in the foreign exchange market, culminating in substantial drawdown in external reserves, and the depreciation of the currency against the US dollar. Real Output growth declined from 5.47 per cent in 2013 to 3.96 per cent in 2015 (CBN, 2015). On the other hand, inflation increased by 150 basis points from 8.00 per cent at end December 2014 to 9.55 per cent at December 2015, despite the tight monetary policy stance adopted by the monetary authorities to curbed inflationary pressure. Key monetary aggregates such as M2 and M1 decreased in the first half of 2015 relative to the levels at end-December 2014. However, net domestic credit of the banking system witnessed mild growth driven mainly by an increase in net claims on the Federal Government and private sector credit (Figure 2).

	2013Q1	2013Q2	2013Q3	2013Q4	2014Q1	2014Q2	2014Q3	2014Q4	2015Q1	2015Q2	2015Q3	2015Q4
Growth rate	4.45	5.4	5.17	6.77	6.21	6.54	6.23	5.94	3.96	2.35	2.84	2.11

Figure 1: Real GDP growth rate, 2013-2015.

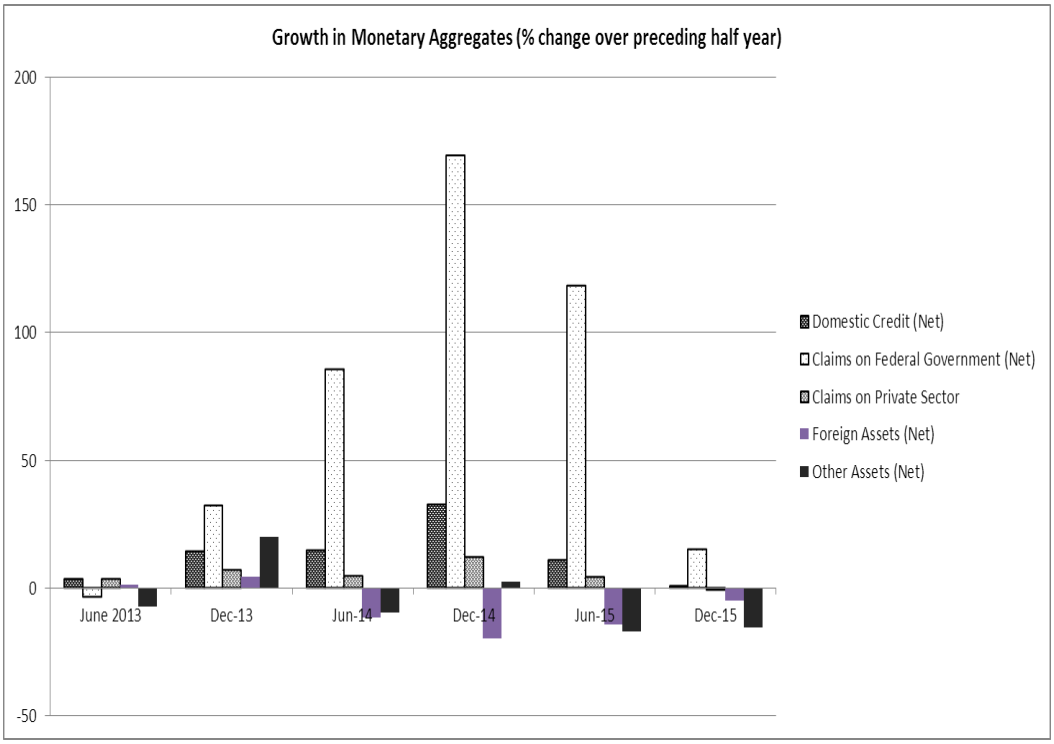


Figure 2: Growth in Monetary Aggregates
Source: CBN Monthly Monetary Survey, December 2015.

Meanwhile, financial soundness indicators deteriorated in the first half of 2015 following the general slump in economic activities attributable to the oil price crash. As shown in Figure 3, the three assets based indicators deteriorated after

consistent good performance in the penultimate years (2013 and 2014). The capital based indicators showed signs of increased vulnerability of the financial sector to credit risk. Howbeit, the income and expense based indicators reflected some level of improvements in cost management strategies by the financial institutions, specifically the banks.

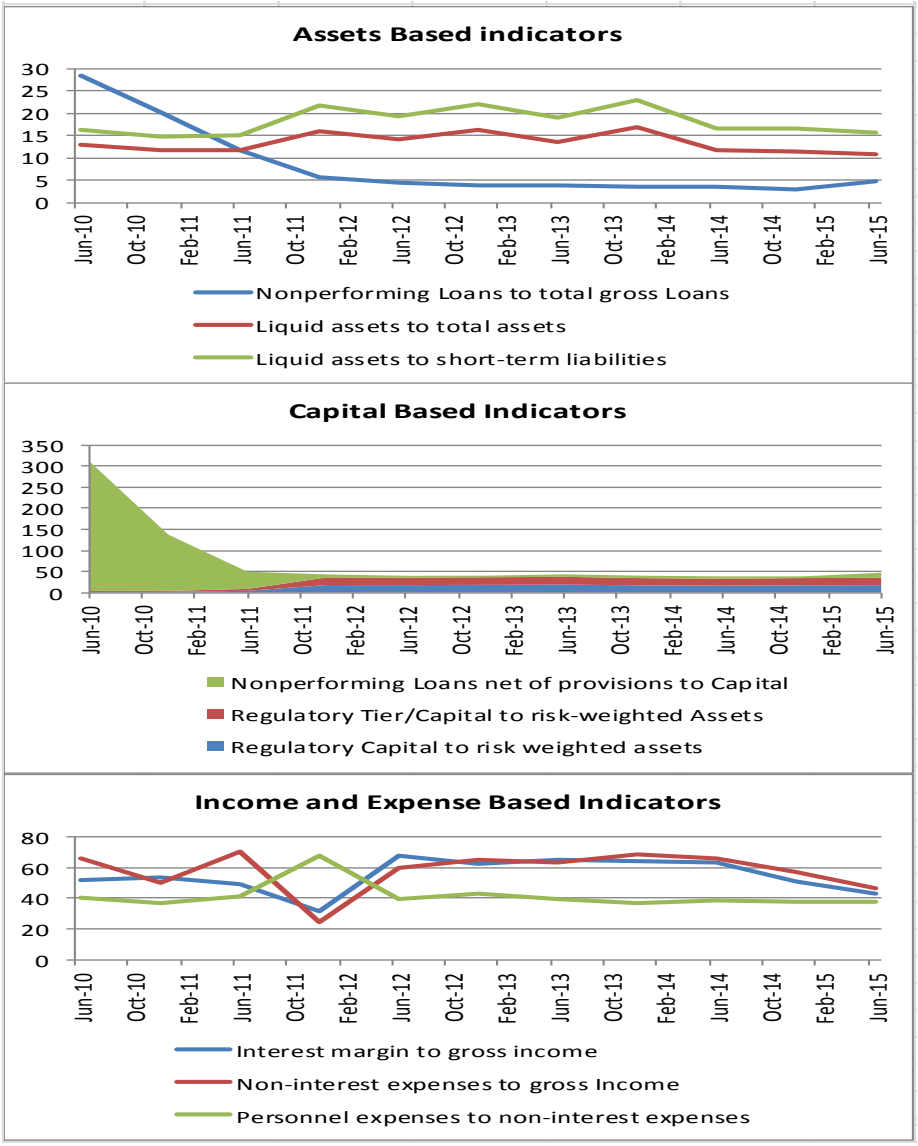


Figure 3: Selected Financial Soundness Indicators of the Nigerian Banking Industry

4. Methodology and Econometric Model Specification

This paper examines the interrelationship between financial system stability policy and monetary policy. Specifically, it investigates whether financial policy dominates monetary policy of the central bank of Nigeria or vice-versa. In doing this, we employ the Granger non-causality approach but allow for structural changes in the data. The Granger non-causality test is usually performed to determine whether the information set on the first variable improves the prediction of the second variable over above its own information. Technically, the Granger Non-Causality test seeks to establish if the lagged values corresponding to the first variable are jointly significant or not.

The standard Granger Causality test assumes that the underlying data are stationary and satisfy the standard asymptotic distributions. However, Park and Phillips (1989) and Toda and Phillips (1993, 1994) have shown the problems that arise when estimating Granger Non-Causality VAR models with non-stationary data. To overcome this problem, Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) proposed a modified standard Granger Causality test that can generate standard asymptotic distribution when the time series in the VAR model are non-stationary or I(1) in specific terms. The modified Granger Causality test estimates a standard VAR for the lag order (p) plus 1 in level of the variables and perform the Granger Non-Causality test on the lag order, p.

In addition, a couple of econometric studies have demonstrated the excellent performance of the **residual based bootstrap (RB) method** over standard asymptotic tests, regardless of whether there is cointegration or not (see for instance, Horowitz (1994), Shukur and Mantalos (2000), Hacker and Hatemi-J (2006)). Hence, following Balcilar and Ozdemir (2013), Aye et al (2015), and Nyakabawo et al (2015), this study adopts the RB based modified Likelihood ratios (LR) statistics to examine the causality between financial policy and monetary policy in Nigeria. The bootstrap modified LR Granger Causality can be illustrated using a bivariate VAR(p) process as follows:

$$X_t = \Phi_0 + \Phi_1 X_{t-1} + ... + \Phi_2 X_{t-p} + \varepsilon_t, \qquad t=1,2,\ldots,T. \qquad (1)$$

Where Xt=(X1t,X2t) is a white noise process with zero mean and covariance matrix ∑ and p is the lag order of the process. Equation (1) can be expanded further by simply partitioning the process Xt into two sub-vectors, representing the financial policy variables (Xft) and monetary policy variable (Xmt). Hence, equation (1) can be rewritten as:

$$\begin{bmatrix} X_{ft} \\ X_{mt} \end{bmatrix} = \begin{bmatrix} \phi_{f0} \\ \phi_{m0} \end{bmatrix} + \begin{bmatrix} \phi_{ff}(L) & \phi_{fm}(L) \\ \phi_{mf}(L) & \phi_{mm}(L) \end{bmatrix} \begin{bmatrix} X_{ft} \\ X_{mt} \end{bmatrix} + \begin{bmatrix} \varepsilon_{ft} \\ \varepsilon_{mt} \end{bmatrix} \quad (2)$$

Where $\phi_{ij}(L) = \sum_{k=1}^{p+1} \phi_{ij,k} L^k$, i,j=f,m and L is the lag operator.

From the preceding, the null hypothesis that monetary policy does not Granger Cause financial policy variable can be tested by imposing zero restrictions Øfm,i=0 for i=1,2,…,p. Put differently, monetary policy variable does not contain predictive content or is not causal, for a particular financial policy variable if the joint zero policy restrictions under the null hypothesis:

H_0^M : Øfm,1= Øfm,2=…= Øfm,p=0 (3)

are not rejected.

Similarly, the null hypothesis that a particular financial policy variable does not Granger cause monetary policy variable implies that we can impose zero restrictions Ømf,i=0 for i=1,2,…,p. In this case, the financial policy variable does not contain predictive content or is not causal, for monetary policy variable if the joint zero restrictions under the null hypothesis:

H_0^F : Ømf,1= Ømf,2=…= Ømf,p=0 (4)

are not rejected.

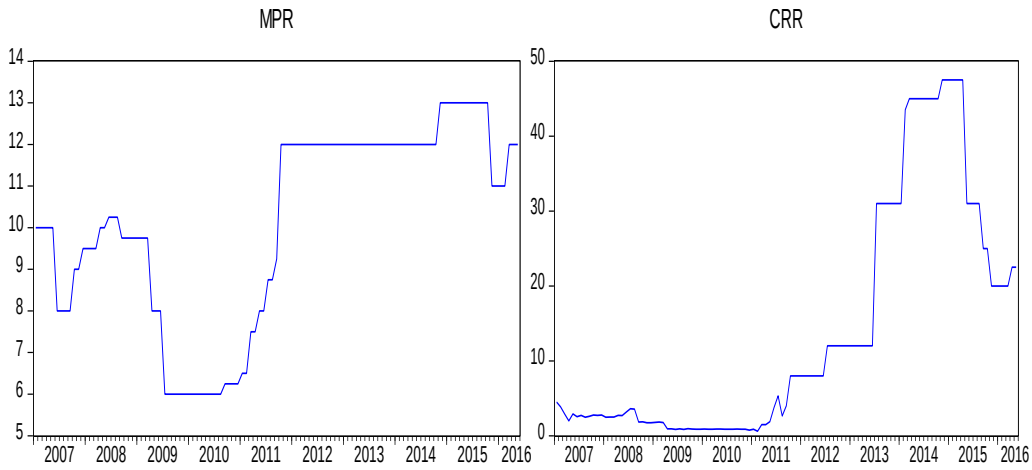
The Granger causality tests in equations (3) and (4) can be linked to the three frameworks identified in Smets (2014) analysis. First, under a narrow definition, which requires only uni-directional causality running from one variable to another, rejection of the H_0^F in equation (4) but not H_0^M in equation (3) established evidence in favour of the financial dominance hypothesis. On the other hand, rejection of the null hypothesis specified under H_0^M in equation (3) but not the null hypothesis under H_0^F in equation (4), supports the monetary policy dominance hypothesis. If both null hypotheses in (3) and (4) are accepted, it implies monetary policy and financial policy are independent of each other. However, under a broader definition of causality, which allows bidirectional causality, evidence in favour of financial dominance is established, if both H_0^F in equation (4) and H_0^M in equation (3) are rejected.

The estimation methodology involves a couple of some familiar steps. First, the time series properties of the variables are determined, followed by the determination of the optimal lag length for the VAR model. Given the possibility of structural breaks and nonlinearity in the data generation process, special unit root test suggested by Lee and Strazicich (2003), Harvey, Leybourne and Taylor (2014) as well as Kapetanios et al (2003) are adopted.

To test for the existence of cointegration among the series, Gregory and Hansen (2009) test for cointegration with structural breaks is carried out. Finally, the Granger Non-causality test is performed based on the standard test and using the rolling causality approach suggested by Balcilar et al (2013).

5. Empirical Results and Analysis

The data used for the analysis are monthly data and spans the period 2007M01 to 2016M05 for Nigeria, yielding 113 observations. The choice of monetary policy variables and financial policy variable was a difficult one. However, the variables are chosen based the relevant literature and data availability. For monetary policy, the monetary policy rate (MPR) and inflation rates are chosen while liquidity ratio (LR) and cash reserves requirement (CRR) are the choice variables for financial policy. The data are obtained from the database of statistics, Central Bank of Nigeria. A graphical presentation of the data is shown on Figure 4.



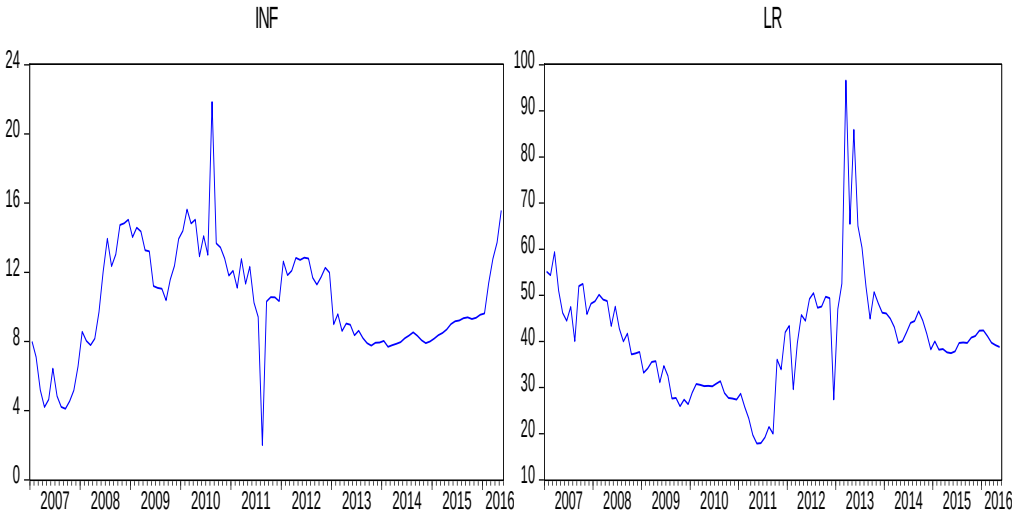


Figure 4: Plots of Monetary Policy Rate, Cash Reserves Requirement, Inflation rate and Liquidity Ratio.

The graphs show kinks and structural breaks in the series. The conventional unit root tests could not be relied upon to yield useful information about the stationarity properties of the variables. Therefore, additional stationarity tests are performed. The results of the conventional unit root tests as well as the results of the unit root test with breaks and nonlinearity are presented in tables 1, 2, 3 and 4, respectively. The results indicate that the four series are integrated of order one after adjusting for nonlinearity and structural breaks in them.

Table 1: The Augmented Dickey Fuller (ADF) Test

Series	Model	Statistics	Remark
MPR	Intercept	-0.9803	Not Stationary
	Intercept and Trend	-1.7896	Not Stationary
	None	0.1381	Not Stationary
D(MPR)	Intercept	-9.9622	Stationary
	Intercept and Trend	-9.9463	Stationary
	None	-9.9958	Stationary
CRR	Intercept	-0.9681	Not Stationary
	Intercept and Trend	-1.5280	Not Stationary
	None	-0.3426	Not Stationary
D(CRR)	Intercept	-10.2517	Stationary
	Intercept and Trend	-10.2049	Stationary
	None	-10.2642	Stationary
INF	Intercept	-2.0903	Not Stationary
	Intercept and Trend	-2.0693	Not Stationary
	None	-0.0093	Not Stationary

D(INF)	Intercept	-15.0855	Stationary
	Intercept and Trend	-15.0213	Stationary
	None	-15.1208	Stationary
LR	Intercept	-2.9977	Not Stationary
	Intercept and Trend	-3.0691	Not Stationary
	None	-1.0596	Not Stationary
D(LR)	Intercept	-7.2817	Stationary
	Intercept and Trend	-7.2707	Stationary
	None	-7.3052	Stationary

Critical values from Mackinnon (1996) are -4.04, -3.45 and -3.15 at 1%, 5% and 10% respectively.

Table 2: Lee-Strazicich unit root test with Structural Breaks

Series	Statistics	Break Date
MPR	-2.3654	2011M09
CRR	-2.2058	2013M06
LR	-3.6905	2011M11
INF	-3.4718	2010M09
D(MPR)	-7.0942	2011M02
D(CRR)	-8.8737	2013M06
D(LR)	-8.3826	2013M01
D(INF)	-12.0494	2010M07

The critical values from Lee-Strazicich (2003) are -4.545, -3.842 and -3.504 at 1%, 5%, and 10% respectively.

Table 3: Harvey-Leybourne-Taylor(2013) Unit Root with Structural breaks Test

Series	MDF Statistics	Break Date
MPR	-2.1455	2008M05
CRR	-2.2530	2007M12
LR	-6.6683	2008M06
INF	-3.6073	2008M02
D(MPR)	-7.2235	2008M02
D(CRR)	-8.8038	2008M05
D(LR)	-7.2712	2008M06
D(INF)	-3.3086	2008M02

The Critical values are -3.95, -3.38 and -3.09 at 1%, 5% and 10% respectively.

Table 4: Nonlinear Unit Root test					
Series	Optimal lag	Kapetanios et al (2003)		Sollis (2009)	
		t-statistics	P-value	t-statistics	P-value
MPR	1	-1.1330	0.2597	0.3274	0.7439
CRR	1	-1.5931	0.1140	0.9620	0.3382
LR	2	-3.8812	0.0001	0.0891	0.9290
INF	1	-2.7650	0.0066	1.4067	0.1624
D(MPR)	2	-3.8094	0.0004	3.9840	0.0001
D(CRR)	3	-3.1816	0.0019	3.1488	0.0021
D(LR)	2	-6.9198	3.70E-10	2.5170	0.0133
D(INF)	3	-3.7983	0.0002	3.6770	0.0003

Given that the series are non-stationary, Gregory-Hansen cointegration with structural changes test is adopted. The results presented in Table 5 show that the series (MPR) and (CRR) are cointegrated. The ADF, Zt and Za statistics are all significant at 5 per cent level of significant. In addition, the break date is determined endogenously as April 2008. This period corresponds with the global financial crisis, when policies are directed at addressing the economic depression.

Table 5: Gregory-Hansen co-integration test Results (Level and regime shifts): MPR and CRR			
Testing Procedure	Test Statistic	5% critical Value	Break Date
ADF*	-8.8451	-4.95	2008M04
Zt*	-8.9010	-4.95	2008M04
Za*	-80.5539	-47.04	2008M04

*Critical values were obtained from Gregory and Hansen (1996)

With these preliminary results, the econometric analysis progressed into the next phase of testing for causality between the variables. The result of conventional Granger Causality test is presented in table 6. The results suggest that there is no pairwise Granger causality between the variables. In other words, indicating that the two policies, financial and monetary, are independent of each other.

Table 6: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
DCRR does not Granger Cause DCPI	110	0.10191	0.9032
DCPI does not Granger Cause DCRR		0.01807	0.9821
DLR does not Granger Cause DCPI	110	0.04303	0.9579
DCPI does not Granger Cause DLR		0.04343	0.9575
DMPR does not Granger Cause DCPI	110	0.21979	0.8031
DCPI does not Granger Cause DMPR		0.50449	0.6053
DLR does not Granger Cause DCRR	110	1.99899	0.1406
DCRR does not Granger Cause DLR		1.01864	0.3646
DMPR does not Granger Cause DCRR	110	0.01952	0.9807
DCRR does not Granger Cause DMPR		0.05845	0.9433
DMPR does not Granger Cause DLR	110	0.27111	0.7631
DLR does not Granger Cause DMPR		0.20261	0.8169

However, some additional information could be obtained if the structural breaks are taken into consideration and causality tested over subsamples of the entire period. The rolling window causality test is, therefore, performed with 40-month rolling windows. To test the null hypothesis of financial dominance, the study estimates the bootstrap LR and their corresponding p-values on the basis of a bivariate VAR of monetary policy rate (MPR) and the cash reserves requirement (CRR). The plots of the bootstrap p-values of the rolling test statistics and the magnitude of the impact of each series on the other are given in Figure 5, with the horizontal axes showing the final observation in each 40-month rolling windows. Figure 5a shows the bootstrap p-values of the rolling test statistics, testing the null hypothesis that financial policy does not Granger-cause monetary policy. The non-causality tests are evaluated at 10 percent significance level. Figure 5b shows the bootstrap estimates of sum of the rolling coefficients for the impact of financial policy on monetary policy. The p-values presented in figure 5a exhibit substantial changes over the sample and the null hypothesis that financial policy does not have predictive power for monetary policy during the period is rejected at 10 percent significance level between December 2011 and August 2012. This implies that financial dominance occurred during this period. Figure 5b shows that for most sub-periods, the sign of the impact of financial policy

on monetary policy was positive but general not significant. Thus, there is no strong and convincing support for the financial dominance hypothesis.

As robustness check, other variables are chosen as monetary and financial policy variables. Inflation rate is chosen as monetary policy variable in accordance with the literature while liquidity ratio is also chosen for financial policy. The rolling window size is increased to 50 months. The results are presented in figures 6 and 7, respectively. In figure 6, the financial variable is liquidity ratio (LR) while monetary policy rate (MPR) is retained as the monetary policy variable. As can be seen from the estimated bootstrap p-values, the results do not change significantly. In figure 6a, the bootstrap p-values of the rolling test statistics, testing the null hypothesis that liquidity ratio (LR) does not Granger cause MPR, is rejected only in January 2012. The magnitude of the impact in figure 6b is not significant at 10 percent. Figure 7a and 7b report the results of test of financial dominance with inflation rate as the monetary policy variable and liquidity ratio as the financial policy variable. Again, the null hypothesis is rejected only in December 2011 and January 2012, respectively. Although the sign of the impact of liquidity ratio on inflation rate is positive, the effect is not significant. These findings suggest that monetary policy during the period is mostly conducted independent of financial policy stance.

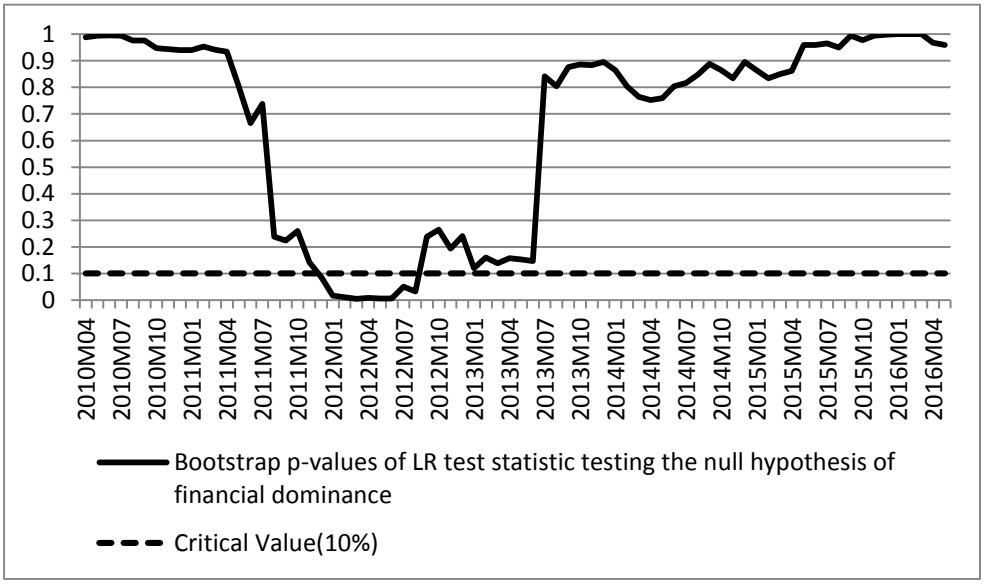


Figure 5a: Bootstrap p-values of LR test statistic testing the null hypothesis that Financial policy (CRR) does not Granger Cause Monetary Policy (MPR)

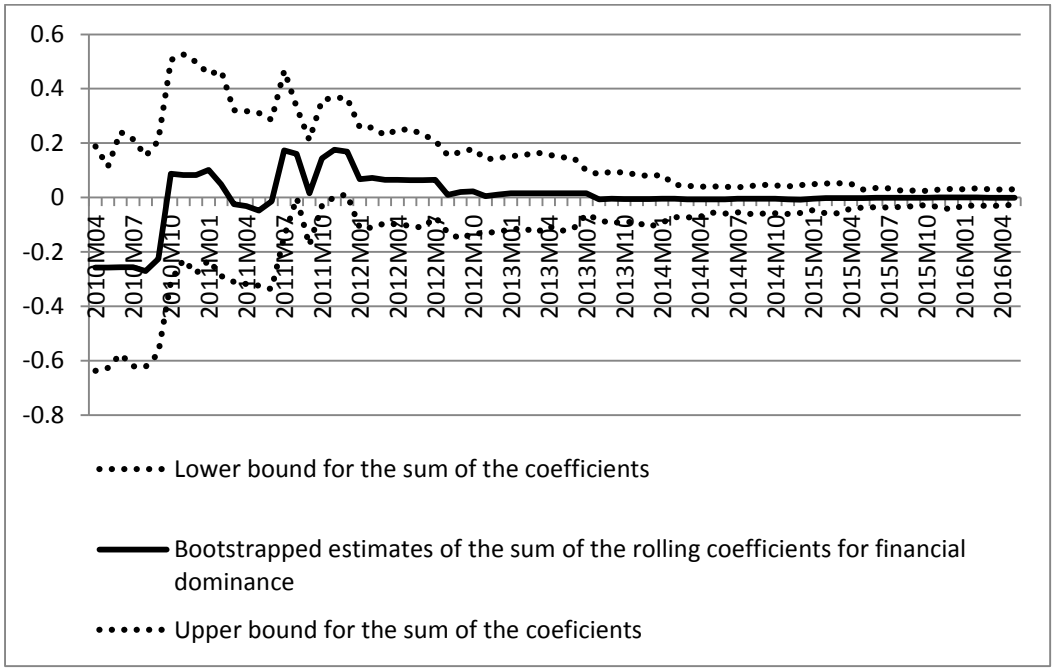


Figure 5b: Bootstrap estimates of the sum of the rolling window coefficients for the impact of CRR on MPR

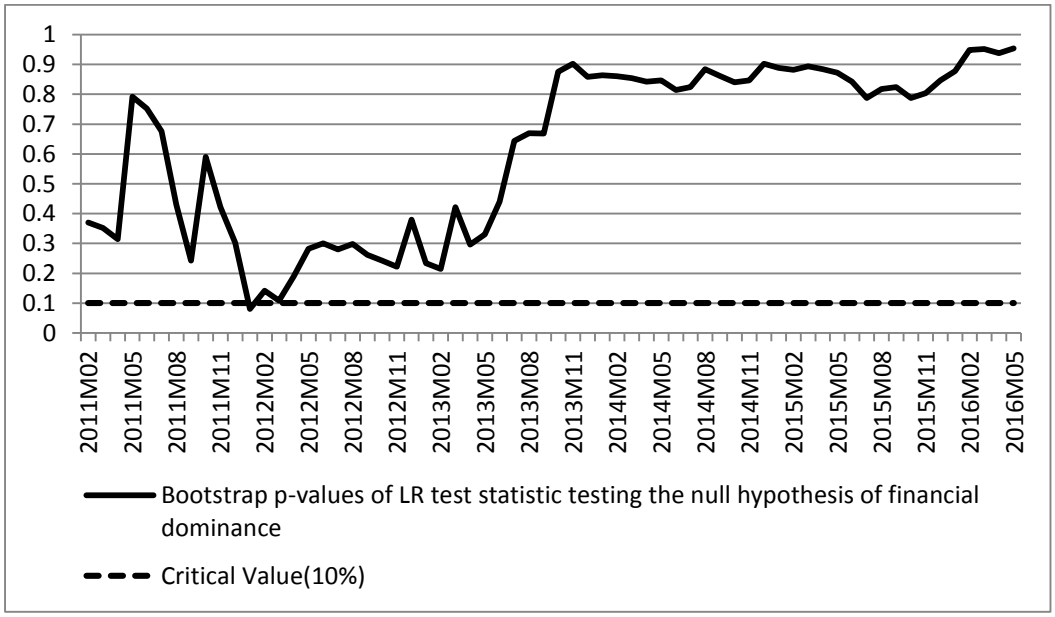


Figure 6a: Bootstrap p-values of LR test statistic testing the null hypothesis that Financial policy (LR) does not Granger Cause Monetary Policy (MPR)

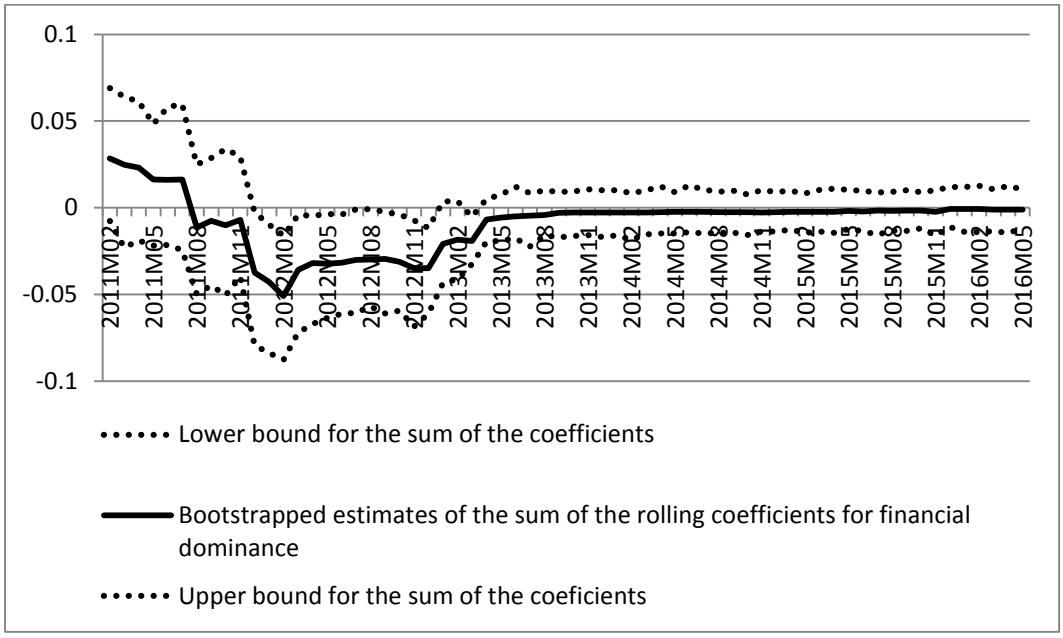


Figure 6b: Bootstrap estimates of the sum of the rolling window coefficients for the impact of LR on MPR

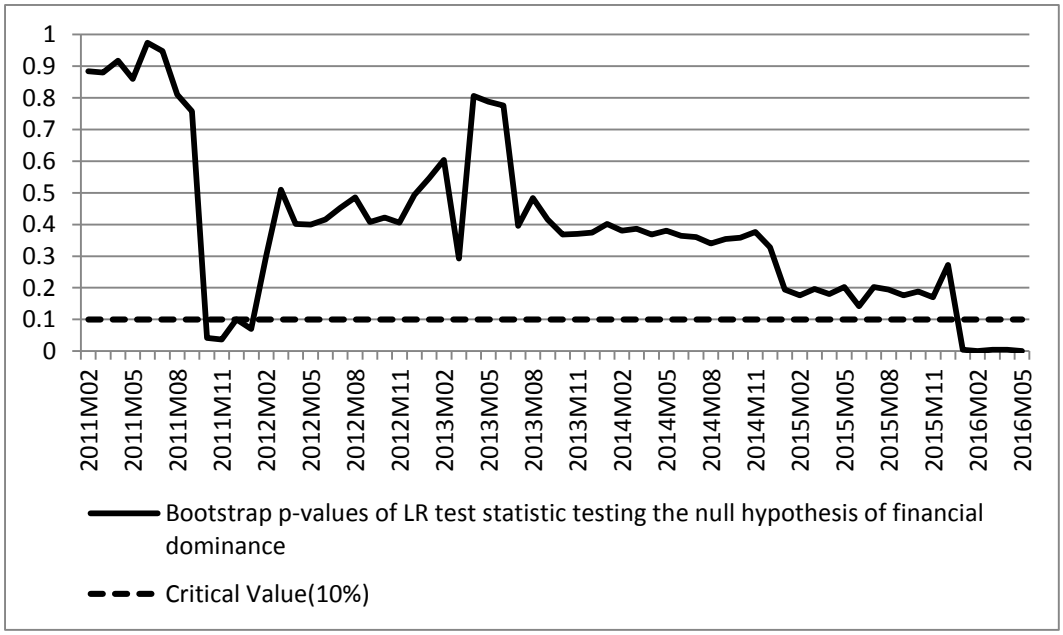


Figure 7a: Bootstrap p-values of LR test statistic testing the null hypothesis that Financial policy (LR) does not Granger Cause Monetary Policy (INF)

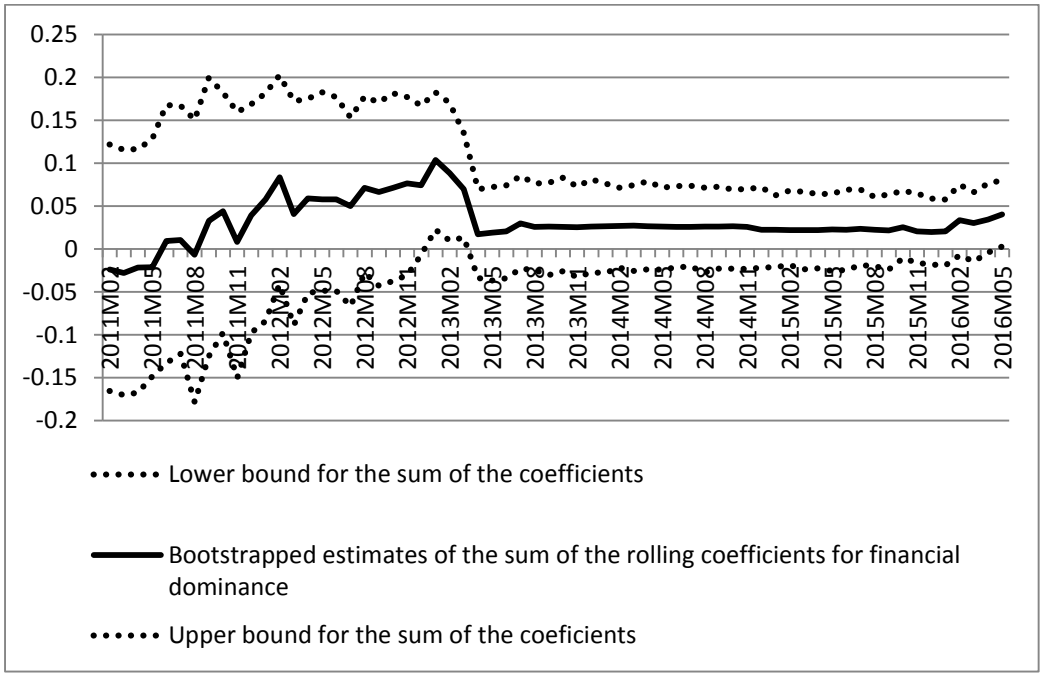


Figure 7b: Bootstrap estimates of the sum of the rolling window coefficients for the impact of LR on INF

6. Summary and Conclusion

The objective of the paper is to test the hypothesis that monetary policy stance of the monetary authorities is driven by the financial stability objective. Given the properties of the data generation process and the structural changes experienced during the period, the rolling window causality test is adopted to test the hypothesis of financial dominance in Nigeria over the period spanning January 2007 to May 2016. The results clearly indicate that monetary policy was independent of financial policy in most of the sub-periods. In other words, monetary policy enjoyed substantial autonomy during the period. Financial dominance was only observed during the periods December 2011 to August 2012. It would be recalled that this period corresponds to the era when strong macro-prudential policies were introduced to address the problems of the banking sector, liquidity surge from AMCON intervention and continued concerns about the quality of banks' asset. During this period, the CRR was increased significantly from around 1 percent in January 2011 to 12 percent by October 2011. Nevertheless, the independence of the two policies calls for strong coordination of financial and monetary policies to attain efficient outcome in management of monetary policy and achievement of financial system stability.

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MACROECONOMIC VARIABLES AND DYNAMICS OF STOCK PRICES IN NIGERIA: AN EVIDENCE FROM THE NIGERIAN STOCK MARKET

Osamede Success Abusomwam[1]

Abstract

This work attempts to investigate the relationship between some macroeconomic variables and stock prices dynamics in Nigeria. The Arbitrage pricing theory forms the theoretical basis for analyzing the relationship. The theory posits that stock prices are affected by some factors, but does not specify these factors. However, some macro-economic variables have been found to affect stock prices in Nigeria including, Money Supply (MS), Industrial Output (INDQ), Real Gross Domestic Product (RGDP), Government Expenditure (GE) and Exchange Rate (EXRT). Employing the Principal Component Analysis; the study finds that INDQ, MS, OIL and EXRT largely influence the dynamics of stock prices in Nigeria and hence the variables are further used in the analysis. Using Generalized Method of Moments (GMM) technic (given that the method allows for nonlinear estimation of regression equations when heteroskedasticity and cross-correlation of stock prices become a concern), the study finds that industrial production, money supply, one period lagged stock prices exert a positive impact on dynamics of stock prices while exchange rate is negatively influenced by stock prices dynamics. The Granger causality results point to a unidirectional relationship between INDP, EXRT, POIL and stock prices dynamics in Nigeria and a feedback effect of MS on stock prices dynamics in Nigeria. Causality is found to run from INDP and POIL to dynamics of stock prices whereas the reverse is the case with EXRT. Industrial sector development is therefore imperative for the improvement of stock market performance in Nigeria, as does efficient monetary policy management.

JEL Classification Numbers: C30, E44, G10.

Keywords: Stock Prices, Generalized Methods of Moments, Industrial Output.

1. Introduction

Understanding how stock prices behave and identifying the factors that affect their dynamics is found crucial in making efficient financial decisions (Fredj & Mondher, 2010). Osamwonyi (2003), is of the view that investors in the stock market make their investment decisions on the information made available to them by the issuer of the securities they want to invest in, reflective of the stock prices. He further states that the rewards the capital market holds out

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to those who read it right are enormous and the penalties it exacts from careless dozing and unlucky investors are calamitous.

The stock market has been described as the hub of the capital market and that stock prices are the main index of stock market performance (Edo, 2014). Alile (1984), holds that the stock market is useful in mobilizing and allocating savings among competing uses critical to the growth of the economy, serving as a medium through which savings of the surplus units are mobilized and efficiently allocated to achieve economic growth (Abiodun & Okunola, 2012). Fama (1998), avers that apart from being a single leading indicator of business cycle, stock market is a predictor of economic activities given that stock prices reflect expected changes in economic activities and changes in the perceived riskiness of stock cash-flows. Edo (2014) has identified some of those changes to be as a result of market conditions in respect of the movement of portfolio investors in the Nigerian capital market.

The Nigerian capital market has no doubt witnessed some relative stability and also recorded impressive growth over the years. This is as a result of the significant role it played in the privatization of public owned enterprises in Nigeria. The re-capitalization of the Nigerian banking sector also provided the capital market the opportunity to raise long term funds for the banks in Nigeria (Okodua & Ewetan, 2013). This has enhanced liquidity in the Nigerian capital market. Liquid markets enhance the mobilization and allocation of capital and since this assists investors in minimizing cost, riskiness in investment is reduced. The liquidity of the market is traceable to some macroeconomic fundamentals. However, the market has witnessed unexpected high fluctuations in the past year. These fluctuations are mostly in the downward trend and are a reflection of the uncertainties in the international oil prices, the depletion in the foreign reserves and uncertainties rocking the foreign exchange market in Nigeria.

The dynamics of stock prices behavior in Nigeria is therefore important given the potentials the market portends for all the categories of investors in the Nigeria capital market (Edo, 2014). A greater emphasis should be placed on stock market development in Nigeria as Pedro and Erwan (2004), observe that stock market development raises output by increasing the capital used in production and by ensuring that capital is put into best uses. In similar position, Argawal (2001) opines that financial sector development facilitates stock market development and in turn raises real growth of the economy.

The rapid decline in All Share Index (ASI) of the Nigerian Stock Exchange in the face of rising inflation, unemployment and fall in foreign exchange reserves and oil revenue could be investigated to finding possible interactions. The Capital

Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) are models that show the relationship between macroeconomic variables and stock prices (Osamwonyi, 2003). Gross Domestic Product (GDP), Exchange rate, inflation rates and interest rates are some of these macroeconomic variables identified by Osamwonyi (2003) as influencing stock prices and influencing investor's decisions in Nigeria. The models form the basis of analysis of these relationships in Nigeria. This work is therefore timely as it beams a searchlight on the macroeconomic variables influencing the dynamic behavior of stock prices in Nigeria.

For ease of presentation, the paper is divided into seven parts. After this introduction, section 2 & 3 undertake a review of literature and analysis of stock market development in Nigeria respectively. Sections 4 and 5 dwell on the model specification respectively, including the method of the principal Component Analysis. Section 6 contains the presentation and analysis of data while section 7 highlights the conclusion, policy implications and recommendations.

2. Review of Literature

The stock market has been described as a place where medium to long term securities are traded (Adeniji, 2010). It is a market in which those individuals, institutions and government who have surplus to their immediate requirements can employ them profitably. Some of the functions of the stock market have been identified as savings mobilization, risk diversification, improved dissemination and acquisition of information (Ohiomu & Enabulele, 2011).

Stock markets the world over have experienced relative growth in the last two decades. Some of the factors identified by Koirala (2009), that led to this growth have included, improved macroeconomic fundamentals, which encompasses monetary stability and higher economic growth. Also, general economic and specific capital markets reforms, including privatization of state-owned enterprises, financial liberalization, and an improved institutional framework for investors, have further encouraged capital markets development (Rajan & Zingales, 1998).

Sudharshan & Rakesh (2011), emphasize the importance of stock markets in explaining the growth process in both developed and developing economies of the world. They point out that the research focus has now shifted to identifying the cause and effect relationship between stock market development and economic growth over the last few decades. The observed phenomenal growth of the emerging stock markets since the late 1980s in terms of market capitalization, listed companies and shareholders has been considered a

significant development by some pundits. In his work, El – Wassal (2005) notes that the growth of the emerging stock markets capitalization has tripled that of the developed stock markets between 1980 and 2000. This shows that the rate of increase of emerging stock markets capitalization in recent years has resulted in increasing interest in understanding the role of these emerging stock markets in explaining the growth process of the developing economies.

Indices of stock market performance include All Share Index (ASI), Market capitalization, number of listed companies, and new issues (Anyanwu, 1993). Maku and Atanda (2009) state that Nigerian Stock Exchange (NSE) All Share Index has been found to be more responsive to changes in macroeconomic variables than other indices of stock prices performance in Nigeria.

Arodoye (2012) finds that there is as much economic as non-economic information on stock prices in Nigeria. Changes in stock market conditions influence the movement of portfolio investors in the market (Edo, 2014). Employing the Vector Error Correction Mechanism, Mukherjee & Naka (1995) find a long run relationship between macroeconomic variables in the Japanese economy and stock returns. Such variables include exchange rate, inflation rate and money supply. Oil prices volatility has been found to increase the risk and uncertainty which negatively affects stock prices and reduces wealth and investment. Park & Ratti (2007), Cong et al (2008), Fredj et al (2010) reckon that fluctuation in oil prices accounted for fluctuations in stock returns. Adaramola (2011) also finds a strong and significant influence of exchange rate, the rate of interest and international oil price on stock prices in Nigeria. Udegbunam & Eriki (2001) find a negative relationship between inflation and stock returns in Nigeria. However, in studying the US stock return dynamics, Firth (1979) spots a positive and significant relationship with inflation rate. Stock returns have also been found to significantly depend on foreign investors in the Nigerian stock market, based on the VECM and VAR model (Edo, 2014).

3. Stock Market Development in Nigeria

The Nigerian Stock Exchange (NSE) was established in 1960 as the Lagos Stock Exchange. It started operations in Lagos in 1961 with 19 securities listed for trading. It became known as the Nigerian Stock Exchange in December 1977. The NSE is regulated by Securities and Exchange Commission (SEC). The Nigerian capital market was deregulated in 1993. Consequently, prices of new issues are determined by issuing houses and stockbrokers while on the secondary market, prices are determined by stockbrokers only.

Prior to 1972 when the Indigenization Decree was promulgated, there were no restrictions to foreign investors in the Nigeria capital market. The Decree also known as Nigeria Investment Promotion Decree was amended in 1977 and effectively restricted capital inflows to a maximum of 40% equity holding in listed securities. The Decree was again amended in 1989 during the privatization era, when it was aimed at encouraging domestic investment by foreigners. Absolute deregulation of the capital market was facilitated by the Nigeria Investment Promotion Commission Act of 1995, Foreign Exchange (Miscellaneous Provisions) Act of 1995 and the Investment and Securities Act (ISA) of 1999. With the ISA in place, foreigners may participate in the Nigeria capital market both as operators and investors. There is no limit any more to the percentage of foreign holding in any company registered in Nigeria. In 2000, the foreign holdings on the Nigeria Stock Exchange stood at 3.96 billion naira on the average. Following this open access to Nigerian capital market, foreign investments in Nigeria rose to 8.5trn naira as at January, 2013.

The deregulation of the financial sector and the privatization exercise, which avail investors and companies of the benefits of the stock market, led to the relative growth of the Nigerian stock market (Alile, 1996). Alile further notes that though the stock market is growing, it is, however, characterized by complexities. The complexities reflected the trends in globalization and increased variety of new instruments being traded: equity options, derivatives of various forms, indexed futures, etc.

The Nigerian Stock Exchange maintains an All Share Index created in January 1984 with the year serving as base year for the computation of the ASI. The index which is value weighted and computed on a daily basis includes only common stock in its computation. The annual average value of the ASI increased from 107.59 points in 1985 to 7, 638.59 points in 1997 after which it experienced the first decline in 1998. The ASI further declined in 1999 to 5, 264.1 points and picked up again in 2000 to hit a record high of 50424.70 in 2008, dropped drastically to 23,091.55 in 2009 and since then had been on a steady increase.

4. The Model

The CAPM as developed by Sharpe (1964), fundamentally is the basis for financial theory on stock prices behaviour. It states that for any asset i,

$$\bar{\gamma}_i - \gamma_f = \beta_i\left(\overline{\gamma_m} - \gamma_f\right);\ \beta_i = \frac{\gamma_{m,i}}{\gamma_m^2} \qquad \textbf{4.1}$$

$$\beta_i\ represents\ beta\ of\ asset\ i\ meaning\ non-diversifiable\ risk$$

For any portfolio of risky asset, $\rho = (\alpha_1, \ldots, \alpha_n)$

Its beta can be computed as a weighted average of individual asset betas.

$\beta_\rho = \frac{\tau_{m,\rho}}{\tau_m^2} = \sum_{i=1}^{n} \alpha_i \beta_i$ **4.2**

When $\beta_i = 0$, then, there is no non diversifiable risk. i.e all risk can be diversified away, hence low returns.

From eqn 1 above,

$\bar{\tau}_i = \tau_f + \beta_i(\bar{\tau}_m - \tau_f)$ **4.3**

Where, $\bar{\tau}_i$ = expected return on stock *i*

$\bar{\tau}_m$ = expected return of the market

τ_f = risk free rate

The model assumes a linear relationship between the expected return in a risky asset and its β and further, assumes that β is a measure of risk capturing cross section of average returns. A positive relationship exists between $\bar{\tau}_i$ and β_i.

The Arbitrage Pricing Theory (APT) developed by Ross (1976), is a general theory of asset pricing that holds that expected return of a financial asset can be modeled as a linear function of various macroeconomic factors or theoretical market indices, where sensitivity to changes in each factor is represented by a factor-specific beta coefficient.

$\tau_j = a_j + b_{j1}F_1 + b_{j2}F_2 + \cdots + b_{jn}F_n + e_j$ **4.4**

Where. a_j is a constant for asset *j*

F_k is a systematic factor

b_{jk} is the sensitivity of the *jth* asset to factor k also called factor loading

e_j is the risky asset's idiosyncratic random shock with zero mean.

The CAPM is considered a special case of the APT. APT is a "supply side" model since its beta coefficients reflect the sensitivity of the underlying asset to economic factors while the CAPM is considered as a "demand side" model arising from the minimization problem of each investor's utility function. Though the APT does not specify factors affecting returns, the characteristics of potential factors include; their impact on asset prices manifest in unexpected movements; represents un-diversifiable influences; theoretical justifications. Chen, Roll & Ross (1986) identified surprises in inflation, surprises in GDP (Industrial production index), short term interest rate, differences in long and short interest rates, oil prices and currency exchange rates as the potential factor in the APT model affecting stock returns.

Tunah (2010), posits that APT is better than CAPM in that it takes into consideration a number of factors that affect the rate of returns on stock. The All Share Index

has been found to be more responsive to changes in macroeconomic variables than do other indices of stock returns in Nigeria (Maku & Atanda, 2009).

5. Methodology and Model Specification

Two broad methods are used in this study for the analysis of dynamics of stock price behaviour in Nigeria. These are the granger causality testing (to ascertain the relevance of causalities between stock returns and the basic macroeconomic variables) and the Generalised Method of Moments (GMM) - to estimate the non-linear relationship between macroeconomic variables and stock returns as prescribed by the APT. However, in an attempt to identify the underlying factors or macroeconomic variables, Principal Component Analysis (PCA) is initially conducted in the study. Generally, PCA is used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger set of variables. This method is used to screen variables for subsequent analysis.

Six variables were selected based on the PCA: the exchange rate (EXRT), an index of industrial production (INDP), the nominal money supply (MS) and price of oil (POIL) real GDP (RGDP), and total government expenditure (TGE). The main factors that help to explain variations in stock prices (SP) in the Nigerian stock market are highlighted using this methodology.

Subsequent to the PCA, the cause-effect relationships between stock prices and the selected factors are examined using the Granger Causality tests; then the overall relationships among the variables are examined using the GMM technique.

Model Specification

The GMM involves the specification of an empirical model in order to empirically determine the main factors that determine share prices within the context of APT. It is hypothesized that the stock prices depend on the variables selected as macroeconomic factors. The model is specified as:

SP = f (MS, INDQ, POIL, EXRT, RGDP, TGE) **5.1**

Where:

SP = stock prices

MS = money supply

INDQ = index of industrial output

EXRT = exchange rate of the naira

POIL = price of oil

RGDP = real GDP

TGE = total government expenditure

Index of stock prices (SP) is computed as:

$$sp = \left(\frac{ASI - ASI_{t-1}}{ASI_{t-1}}\right) X\ 100$$

The a priori expectations in the model are:

$$f_{ms},\ f_{indq},\ f_{poil},\ f_{rgdp},\ f_{tge} > 0;\ f_{poil} < 0$$

In the model, money supply, industrial production, oil prices, real income levels, and government expenditure are all expected to exert positive influences on stock prices since they indicate improvement in economic conditions and this tends to drive up investors' participation in the stock market. The exchange rate, on the other hand, is expected to have a negative input on the price of equities since it is a cost of funds. Thus, a negative effect is expected between exchange rate and stock returns. Funds become scarce as the exchange rate depreciates, this will lead to rise in domestic prices including share prices. It should be noted that the final choice of the variables for the model will be based on the outcome of the Principal Components Analysis (PCA).

Method of Principal Components Analysis

The first step is to determine how many Components are necessary to describe a reasonable amount of the sample's variability and reduce the dimensionality. This question does not have a closed answer. This is explained by Principal Component Analysis (PCA). The PCA is a multivariate technique that analyses a data in which observations are described by several inter-correlated quantitative variables. It is a multiple factor analysis that handles heterogenous sets of variables. It is an analysis based on the eigen-decomposition of positive semi-definite matrices and upon the singular value decomposition of rectangular matrices obtained as linear combinations of the original variables.

Given that A and B are m x n matrices related by linear transformation Q. if A is the original data set and B is the re-representation of A, then,

$$QA = B$$

Q represents a rotation and stretch of A which transforms A to B. in determining the appropriate basis in the transformation, the Q's become the principal component of A. The covariance matrices is denoted as S_A and is given as

$$S_A = \frac{1}{n-1} AA^T \; where, \begin{bmatrix} A_1 \\ \bullet \\ \bullet \\ \bullet \\ A_m \end{bmatrix}$$

Then find some orthonormal matrix Q such that

$$S_B = \frac{1}{n-1} BB^T$$

is diagonised. The rows of Q become the principal components of A. The magnitude of the eigenvalues and the proportion of each to the explained variability determines the principal components of A.

The macroeconomic outlook of the variables used in the analysis may imply simultaneity among them. Hence, before applying the GMM estimation, the Granger causality test is used to provide the background for estimating dynamic relationships. The granger causality test shows whether causality runs from one variable to another. The basic specification of the test structure is presented as:

$$Y_{it} = \beta o + \sum_{k=1}^{m} \beta_k Y_{it-k} + \sum_{L=1}^{n} \alpha_j X_{it-j} \qquad \textbf{5.2}$$

$$X_{it} = \sum_{k=1}^{m} \delta_k X_{it-k} + \sum_{L=1}^{n} \varphi_j Y_{it-j} \qquad \textbf{5.3}$$

where:

Y_i = stock prices

X_i **=** macroeconomic factors

Thus five equations are to be estimated based on the formulations in equations 5.2 and 5.3.

'k' and 'j' = the number of lags

α_j, β_k, δ_j, and φ_k are all paremeters to be estimated.

Owing to the non-linear nature of the asset pricing model, the Generalized Method of Moments (GMM) model is specified in this study. The GMM is an estimation procedure that allows for non-linear estimation of the regression equations when heteroskedasticity and cross-correlation of returns is a concern. Briefly, the GMM estimator is computed by minimizing the quadratic form

$$\boldsymbol{q} = \mathbf{m}' \mathbf{W}^{-1} \mathbf{m} \qquad \textbf{5.4}$$

where

$$\boldsymbol{m} = \mathrm{T}^{-1} \sum Z_t^1 \otimes u_{t+1} \qquad \textbf{5.5}$$

and W is the asymptotic variance/covariance matrix for the orthogonality conditions m or the weight factor. This weight factor may be determined by various means and Hansen (1982) shows that an *asymptotically efficient*, or *optimal* GMM estimator of the parameter may be obtained by choosing W so that it converges to the inverse of the long-run covariance matrix. Z_t is any subset of the variables in the current information set and is used to capture the instruments in the model, q is the moment condition to be minimized and T is the entire time period that is used to obtain the average moments.

To perform the estimation requires data on stock prices, and instruments from the public's information set (i.e., macroeconomic factors in this study). Based on this framework the equation for stock prices is estimated. Stock prices (SP) is regressed on a constant and lagged stock prices itself. The use of lags is consistent with the rational expectations hypothesis (Wooldrige, 2001). The instruments in the GMM will be a constant term and the factor loadings initiated by the factor analysis. A Heteroskedasticity and Autocorrelation Consistent Covariance (HAC) weighting matrix will be used to determine the weight (W), with pre-whitening (fixed at 1 lag as suggested in Wooldrige, 2001). The HAC weighting matrix is an estimator of the long-run covariance matrix of the parameters in the model which usually corrects for heteroskedasticity and autocorrelation in the system.

The Data

The data used in the study are annual data covering the period 1985 to 2014. This is the period for which the stock price data are available in Nigeria. The data are all sourced from the CBN **statistical Bulletin**.

6 Presentation and Analysis of Data

6.1 Descriptive Statistics

The summary statistics for the variables identified in the study are presented in Table 4.1 below. Stock Prices has a mean value of 5.68 and a high standard deviation of 8.46, suggesting that prices have been very unstable in the market over time. This can be seen in the relatively high standard deviation of the data, although the skewness value is quite low and suggests closeness to the mean. In the same vein, the J-B test indicates non-normality in the distribution of the data since associated probability for the value is less than 0.05 (5 percent). Among the risk factor variables, the relative standard deviation (in relation to the mean value) of oil price shows that it is the most dispersed variable and the most volatile. This implies that oil price movement over the period was uneven and a measure of risk could have been associated with it. The log of industrial production index and log of real GDP reported the least variability values since their respective standard deviations are the least. However, the J-B test shows that, apart from oil price volatility and stock prices, all the data series are normally distributed and hence, no much heteroskedastic problems are associated with the data estimation. This is because returns and oil price series are the only ones with significant J-B value at the 5 percent level.

Table 6.1: Summary Statistics of the Data

	Mean	Median	Std. Dev.	Skewness	Jarque-Bera	Probability
R	5.68	6.10	8.46	-0.46	10.07	0.01
LINDQ	4.87	4.88	0.11	-0.49	1.09	0.58
LMS	13.16	13.10	2.03	-0.03	1.67	0.43
LRGDP	12.81	12.65	0.46	0.55	2.39	0.30
LTGE	12.82	13.10	1.83	-0.38	2.06	0.36
POIL	31.63	21.15	43.55	2.01	6.91	0.02
EXRT	61.82	21.89	55.60	0.28	1.24	0.39

Source: Author's Computations

6.2 PRINCIPAL COMPONENT ANALYSIS

The result of the component analysis is reported in Table 6.2 below. It shows that the first Component alone explains around 66 percent of the variability of the data and that around 99 percent is explained by the first four Components. Additional Components marginally contribute with very small variance´s proportion. Considering what was exposed therefore, four Components will be adopted as describing a fair amount of the sample's variability.

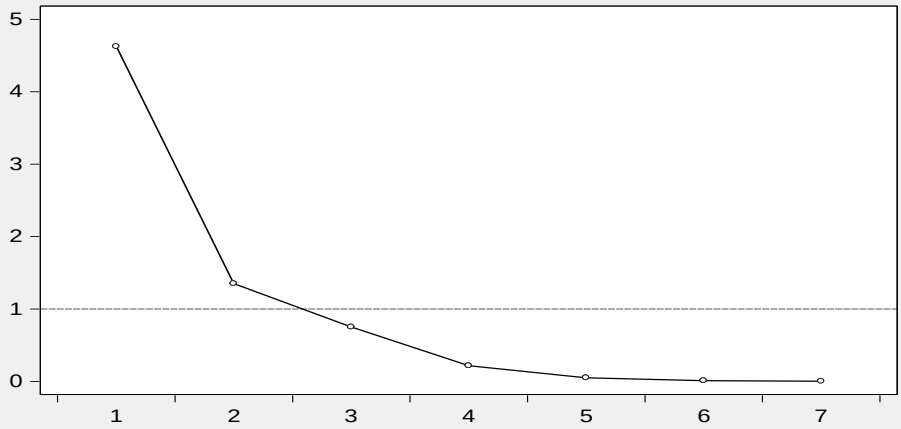
Table 6.2: Principal Component table

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	4.631	3.286	0.662	3.631	0.662
2	1.345	0.593	0.192	4.975	0.854
3	0.752	0.532	0.108	5.728	0.961
4	0.220	0.175	0.032	5.948	0.993
5	0.046	0.041	0.007	5.994	0.999
6	0.005	0.004	0.001		1.000

Source: Author's Computations

The Scree plot for the graph of the ordered eigenvalue´s magnitudes as generated by Eviews is reported to further indicate the performance of the components as risk factors. Compared to the value of the first eigenvalue (4.631) around the fourth one the difference between successive eigenvalues is already reduced to less than 0.2, and the magnitudes itself are relatively close to zero as the components increase. Thus, it is imperative to choose the number of components at four factors in this analysis.

Fig. 4.1: Scree Plot (Ordered Eigenvalues)



Source: Generated from Underlying Data by Eviews 8

The Granger causality test, which is a preliminary aspect of a GMM analysis, is used to provide the background for estimating dynamic relationships. The results of the Granger causality tests are reported in Table 6.3 below. As is generally the case, the F-test is conducted on the null hypotheses in order to determine the direction of causality between each pair of variables. The rejection of each of the null hypothesis is based on the significance of the F-value for the particular relationship.

The test result shows clearly that there is a feedback relationship between stock prices and money supply, suggesting that while money supply Granger causes stock prices, money supply also responds to movements in stock prices over time. Unidirectional relationships exist between stock prices and the other variables in the analysis. It is also seen that causality runs from both industrial production and oil prices to stock prices, indicating that they both Granger cause stock prices without a reverse relationship. However, the pattern of Causality actually runs from stock prices to exchange rate and not the other way round. These directions of causality indicate that simultaneity issues are inherent among these variables. The study thus adopts an appropriate estimation technique to investigate the empirical relationships.

Table 6.3: Granger Causality Test results

Null Hypothesis:	F-statistic	Probability	Decision	Causality
MS does not Granger Cause SP	3.553	0.033	Reject	**Feedback**
SP does not Granger Cause MS	3.099	0.049	Reject	
INDP does not Granger Cause SP	2.601	0.079	Reject	**Unidirectional**
SP does not Granger Cause INDP	0.689	0.505	Accept	
EXRT does not Granger Cause SP	1.384	0.256	Accept	**Uni-directional**
SP does not Granger Cause EXRT	3.093	0.050	Reject	
POIL does not Granger Cause SP	3.143	0.048	Reject	**Uni-directional**
SP does not Granger Cause POIL	0.384	0.683	Accept	

Source: Author's Computations;

Note: the test of significance is based on 5% level

6.3 EMPIRICAL ANALYSIS

In this section, the estimated results for the empirical model are presented and analysed. In order to present a robust analysis, the OLS estimates of the relationships are reported along with the GMM results. Although the OLS results look good with adjusted R-squared value of 0.97 and D.W. value of 1.97 (indicating no autocorrelation in the errors), the coefficient estimates are very poor in terms of the t-ratios. Only the coefficient of lagged stock prices passes the significance test at the 5 percent level. When compared with the results of the GMM estimates, it can be seen that GMM is superior to OLS in APT application.

The overall performance of the GMM model is quite impressive. The adjusted R-squared value is 0.90, indicating that over 90 percent of the systematic variations in stock prices are explained in the model. The R-squared value is also high, indicating that the model has a high predictive ability.

Table 6.4: Estimation Results

Variable	GMM			OLS		
	Coefficient	T-Ratio	Prob.	Coefficient	T-ratio	Prob.
Constant	-1.290	-0.358	0.72	-0.518	-0.075	0.94
SP(-1)	0.719	6.597	0.00	0.781	3.897	0.00
LINDQ	1.423	3.069	0.00	1.199	1.517	0.14
LPOIL	-0.020	-0.178	0.86	-0.025	-0.105	0.91
LEXRT	-0.571	-2.268	0.034	-0.506	-0.709	0.48
LMS	0.331	1.977	*0.06*	0.282	0.537	0.59
	R^2 = 0.978 R-bar Squared = 0.90 J-test = 4.57			*Adj. R^2 = 0.92 F = 144.9 DW = 1.97*		

The individual performance of the risk factors in explaining stock returns is determined by examining the coefficients of the explanatory variables. Surprisingly, the coefficient of oil price possesses negative signs. This is not in line with *a priori expectation indicated* in section five since rising oil prices should help to stimulate returns. However, the coefficient of POIL fails the significance test at the 5 percent level and implies that oil prices are not a strong risk factor considered in equity stock pricing. Apparently, oil price movements do not transmit strong signals to the stock market in Nigeria. This also shows the level at which the Nigerian Stock Market has been de-linked with the oil sector which often experiences external volatility as a result of unstable international prices. All the other coefficients possess the expected *a priori* signs in the GMM results.

The coefficients of lagged stock prices and that of index of industrial production pass the significance test at the 1 percent level, while that of exchange rate passes the test at the 5 percent level. However, the coefficient of money supply only passes the 10 percent test. Thus, money supply may not actually exert strong influences and hence may not constitute a potentially effective risk indicator in stock pricing in Nigerian stock market. Although money supply has the same positive effect on stock prices the poor significance suggests that monetary policy which controls the monetary base may not produce the appreciable results if it is used to monitor stock market performance.

The result shows that index of industrial production is a very strong indicator of stock market risks and returns performance since the coefficient of INDQ is significant at the 1 percent level. The impact of the industrial index on stock prices is positive; as the industrial sector grows, equity stock assets seem to be boosted. The industrial sector production is therefore seen as a very effective tool for predicting stock prices in Nigeria and is therefore a strong risk factor.

The implications of the results from the GMM estimates are that past prices are effective means of observing risks in stock prices in the market since the coefficient of lagged prices is also significant. This suggests persistence in any form of disequilibrium that may arise in the short run in the Market. Apparently, the Nigerian Stock market does not appear to be quickly self-correcting in the event of short term shocks. The naira exchange rate also passes the test but has a negative coefficient, indicating that depreciation of the exchange rate actually leads to poor market performance.

In terms of policy factors, the exchange rate and industrial production could be used as strong factors in predicting stock market behavior and thereby extensively controlling it. While industrial production can suggest positive and beneficial behavior in the stock market over time, the naira exchange rate is a tool for observing negative expected risks in the Nigerian Stock exchange.

For the GMM estimation the over identification restrictions test is also performed since it is a system estimation technique. The test shows whether the estimates are econometrically consistent based on the methodology. The J-statistic (reported in Table 6.5 below) fail the significance test at the 5 percent level because the computed value of 4.0 is less than the 5 percent critical Chi-square value of 9.64 (with 4 degrees of freedom). This indicates that the null hypothesis that the over-identifying restriction is equal to zero cannot be rejected. Consequently, the study cannot reject the specification of a GMM model to identify the relationships.

Table 6.5: Test of Overidentifying Restriction

	Value	Df	Probability
Difference in J-stats	4.005537	5	0.5486
J-statistic summary:			
	Value		
Restricted J-statistic	4.005537		
Unrestricted J-statistic	0.000000		

7. Conclusion, Policy Implications and Recommendations

There has been growing concerns about factors responsible for the decline of stock prices in the Nigerian stock market. This work has sought to investigate the dynamics of stock prices in Nigeria. Specifically, this study aims at finding out, how well the APT explains the dynamics of Stock prices in Nigeria. A cursory look at the factors determining the variation in stock prices will assist all stakeholders in the Nigerian stock market in making profitable investment decisions. The theory of the APT which shows the determination of stock prices is presented in detail. Adopting the GMM method of analysis, the study finds that most of the macroeconomic variables used – index of industrial production, money supply and exchange rates – perform relatively well in explaining the nature of pricing of equities in the Nigerian stock market. The only factor that is found insignificant is the oil price variable.

The main policy conclusions that may be inferred from these results are compelling. First, since industrial production significantly poses risks in assets pricing, it is important for the industrial sector to be improved in Nigeria. As a corollary, stability and sustainability in industrial growth in the country is critical to the long term efficiency of the stock market. The industrial policy in Nigeria, therefore should effectively incorporate the inter linkages with the stock market. When industrial sector is well positioned, its movements can be a major long term indicator for stock market performance.

Second, the negative impact of the exchange rate on stock returns suggests that appropriate exchange rate policy must be adopted. In the same vein, when exchange rate policies are being made, the effects on the stock market must be taken into cognizance since this is one of the first markets to respond to unstable exchange rate. Perhaps, this is a reflection of the depth of the stock market in Nigeria. Therefore, economic policies which improve the country's exchange rate should be adopted. This will in the long run stabilize stock prices and investors may be attracted to the stock exchange.

Third, money supply also has the same positive effect on stock prices as industrial output, indicating that monetary policy which controls the monetary base could be used to monitor stock market performance. Arbitrary policy shifts that focus only on the traditional interest rate monetary transmission channel should be reviewed. Authorities should acknowledge that monetary policy effectively directs asset pricing in Nigeria. Moreover, when a distortion in the stock market is anticipated, monetary policy should be the main tool to make necessary adjustments for long run sustainability.

Finally, the poor performance of the oil price variable in the analysis reflects the weak effect of the oil sector and the de-linkage that exists between the oil sector and the stock market. This can be seen as both a positive and negative outcome. Thus, the market regulators and especially the investors should arrange the stock market in such a way as to ensure optimum inflows of oil sector finances. This can help to limit short term fluctuations in the market that are often associated with oil prices

The results in this study are by no means exhaustive considering that many other macroeconomic factors that are not brought on board may actually be effective risk factors in equity stock pricing in Nigeria. Moreover, in further research, the portfolio of assets may be extended to include other non-equity assets as they are becoming more ubiquitous in the capital market.

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CURRENCY SUBSTITUTION (CS) AND ECONOMIC GROWTH IN NIGERIA: EVIDENCE FROM VECTOR AUTOREGRESSIVE (VAR) METHOD.

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Abstract

This paper investigates the impact of currency substitution (CS) on economic growth in Nigeria and also determines the relationship between CS and inflation using time-series data. The data for the analysis covered the period from 1995 through 2013. A vector autoregressive (VAR) model is estimated to analyse the inter-relationships between CS, economic growth and inflation in Nigeria. The most important finding of the study is the significant impact of CS on economic growth in Nigeria. It is found also that CS is present in Nigeria and that inflation is positively and significantly related to CS. Since inflation makes economic agents to prefer foreign currency to national currency especially if inflation is expected to persist, it is therefore recommended that efforts should be made by government through monetary authority to curb high and rising inflation through the use of mix optimum policy (monetary and fiscal). This will reduce the impact of CS on economic activities.

Keywords: CS, Economic growth, Inflation, Exchange rate & VAR

JEL Classification: C22, C32, E51 & E31

1.0 INTRODUCTION

In the extant literature, several factors have been identified as the determinants of aggregate output/income. Apparently, currency substitution (CS) cannot be left out. The relatively close empirical relationship between CS and economic activities (particularly aggregate income) has been demonstrated by many studies (Dallas, Balter and Hafer, 1985; Viseth, 2001; Feige, 2003, Doguwa, 2014 and Ozienbge, 2015). It has been argued recently, however, that CS has negative effect on the macroeconomic policies of the domestic currency. For instance, Boamah, Guy, Grosvenor and Lescott (2012), note that increased currency substitution may have several negative spill-over effects such as weakening the autonomy of monetary policy; increasing vulnerability to

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economic shocks; the potential for significant deterioration of the balance of payments account and/or exchange rate volatility. In truth, CS can also lead to a distortion in various measures of macroeconomic activity making the formulation of macroeconomic policy more difficult (Feige, 2003). Further, CS has the potential to negatively impact overall economic growth, especially for small open economies (Doguwa, 2014). Therefore, CS is the replacement (part or whole) of domestic currency with foreign currency. The effect of such replacement perhaps is the increase in the quantity of foreign currency (particularly as a means of storing wealth and a medium of exchange) and thereby reducing the value of the domestic currency.

It can been argued to a large extent, that the relationship between CS and economic activities (income) may be affected by some measure of influence – inflation and exchange rate movements for instance. The literature is replete with studies on the impact of inflation on economic activities (Bawa and Abdullahi, 2012; Danladi, 2013 and Doguwa, 2013). Generally, inflation is thought of to exact negative influences on economic activities especially during period of rising prices. Inflation also impedes CS because during period of rising and persistent inflation, most economic agents will prefer to substitute foreign currency for domestic currency (whose value has been depleted by inflation) and they will also desire to hold their wealth in foreign currency particularly if it is expected that inflation will persist. Thus, inflation leads to the presence of CS in the economy especially if it is expected to persist.

Exchange rate on the other hand, especially depreciation tends to reduce the desirability of the local currency vis-a-vis the foreign currency. Basically, during exchange rate depreciation, economic agents will prefer to hold foreign currency instead of the local ones. Thus, CS always leads to a weakening of the domestic currency and virtually endless depreciation of the local currency. Therefore, the issue of currency substitution and its policy implications remains of interest to researchers and economists, and investigating the interrelationships between currency substitution and economic growth cum CS and inflation will offer policy direction and proper guide for policymakers in Nigeria.

The main objective of this study therefore is to assay the effect of currency substitution on economic growth using vector autoregressive (VAR) method. Also, the study will investigate the dynamic causal and feedback relationships between currency substitution and inflation cum the policy implications of the results for macroeconomic policy in transitional countries, particularly, Nigeria. The study will contribute to extant literature by investigating in a comprehensive manner the interrelationships between currency substitution and economic growth in Nigeria as well as other variable(s) used in the study by employing VAR

model which takes cognizance of the dynamic-causal relationship as well as the dynamic feedback effect of variables included in the VAR model. Arguably, this methodology has not been used to investigate the inter-relationship between CS and economic growth in Nigeria. Thus, this is the gap the study sets out to fill.

The rest of the paper is divided as follows: section II focuses on literature on currency substitutions and economic growth with special attention to currency substitution-growth evidence and theories. Currency substitution-economic growth-VAR model is presented in section III while section IV discusses empirical results. Conclusions are presented in section V.

2.0 Literature Review

2.1 Concept of Currency Substitution (CS)

Calvo and Vegh (1992) define currency substitution as the substitution of domestic currency by foreign currency in its role as a means of payment, unit of accounts, and store of value. Recent studies have supported this definition, for instance, Clements and Schwartz (1992); Agenor and Khan (1992) and Viseth (2001). Particularly, Viseth (2001), apparently sees currency substitution to suit the purpose of means of payments, unit of account and store of value in domestic and transitional countries especially where the domestic currency is weak. Thus, currency substitution is assumed as the best preferred alternative to domestic currency in the instance that domestic currency cannot be trusted.

McKinnon (1982), on the other hand, define currency substitution in two ways. First, as direct currency substitution which implies the use of foreign currency and second as indirect currency substitution which implies foreign currency denominated bonds by domestic residents. Howbeit, no matter the context currency substitution is defined, either as the substitution between two monies [Mizen and Pentecost (1996); Ramírez-Rojas (1985) and Rojas- Suarez (1992)], or as sheer replacement of a domestic currency by another currency [Giovannini and Turtelboon (1992)], and better still as a substitution in which domestic currency demand is influenced by foreign economic variables [Tanzi and Blejer (1982), Rogers (1990), and Marquez (1985)], the effect and implications for the domestic economy is alike.

2.2 Measures of Currency Substitution

There are two broad ways of measuring currency substitution as identified by Leung and Ngo (1999). They are *stock concept* and the *behavioural concept*. The stock concept refers to the amount of foreign currencies in a country, which conventionally can be viewed in terms of the volume of foreign currencies circulating in a country and the foreign currency bank deposits of its resident expressed as a ratio of domestic money. On the other hand, the behavioural concept measures the propensity for domestic residents to switch into foreign currency holdings in response to changes in economic determinants such as exchange rate depreciation, changes in the inflation rate and interest rate (Viseth, 2001). The stock concept is a very difficult one because of the behaviour of domestic residents towards the monetary authority's regulatory policy in holding foreign currency. The most appropriate measure perhaps because of the ease of availability of data and measurement is the use of foreign currency deposit (FCD) as against foreign currency in circulation (*FCC*) and cross-border deposits (*CBD*). In the context of developing and transitional economies where data availability and reliability are major challenge, FCD would be a better measure. (*FCC*) and (*CBD*) are not feasible in developing economies because of the nature (underdevelopment) and bottlenecks (the easy of not getting data) in the financial system. The most common approach of currency substitution is the ratio of FCD to broad money.

The study uses the most common approach in the measurement of currency substitution. This approach is suitable for Nigeria because of her monetary framework and the ease of data. Many studies have utilized this approach. For instance, Agénor and Khan (1992), Sahay and Végh (1996), Savastano (1996) and Clements and Schwartz (1992)] while for evidence in Nigeria, the study recognises the works of Adom, Sharma and Morshed (2006), Doguwa (2014) and Oziengbe (2015).

2.3 The Pros and Cons of currency substitution in Economic Growth / Development

Currency substitution has been identified to have positive and negative effect on the economy, especially in emerging economies. Financial deepening is one of the positive effects of currency substitution (CS). On the negative effect, CS tends to weaken the effectiveness of monetary and exchange rate policies. The benefits and shortcomings of currency substitution are summarised in Table 1 as identified by Viseth (2001).

Table 1: Benefits and Shortcomings of CS

S/N	Benefit	Shortcoming
1	It enhances the opportunity for reintermediation and promote financial deepening in economies that have experienced long periods of high and variable inflation and unfavourable macroeconomic conditions.	It leads to reduction in the real demand for domestic currency.
2	It can lower inflation by tying money supply to monetary policy	Greater exchange rate volatility (See Girton and Roper, 1981)
3	It makes longer-term lending and borrowing possible thus contributes to stable investment environment and higher economic growth	It leads to the limitation of the effectiveness of monetary and exchange rate policies

Source: *Author's compilation from Viseth (2001).*

2.4 Selected causes of CS in Nigeria

Table 2 shows the causes of CS in Nigeria and their relationship

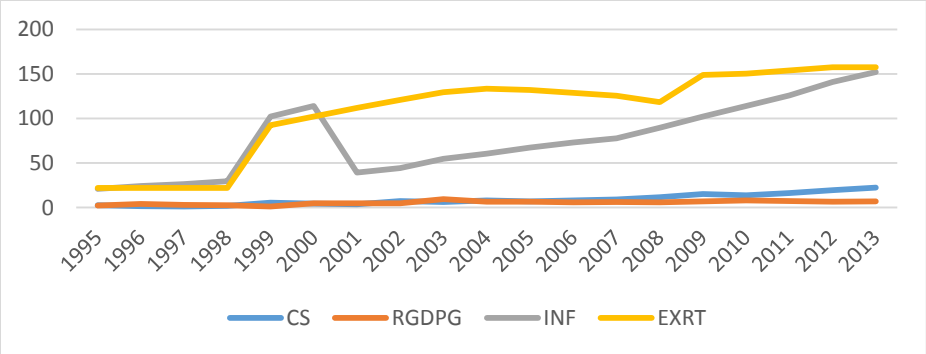
Table 2: Currency substitution, Growth rate of real GDP, Inflation and Exchange rate in Nigeria

YEAR	**CS**	**RGDPG**	**INF**	**EXRT**
1995	2.5	2.15	21.0	21.9
1996	1.6	4.13	24.4	21.9
1997	1.3	2.89	26.4	21.9
1998	1.9	2.82	29.6	21.9
1999	5.6	1.19	102.2	92.7
2000	4.3	4.89	114.2	102.1
2001	3.7	4.72	39.5	111.9
2002	7.2	4.63	44.3	120.9
2003	6.3	9.57	54.9	129.4
2004	8.1	6.58	60.4	133.5
2005	7.1	6.5	67.4	132.2
2006	7.9	6.0	73.1	128.7
2007	9.3	6.4	77.9	125.8
2008	11.5	5.9	89.7	118.6
2009	15.3	6.9	102.2	148.9
2010	13.7	7.9	114.2	150.3
2011	16.2	7.4	126.0	153.9
2012	19.6	6.6	141.1	157.5
2013	22.4	6.9	152.3	157.5

Source: Author's compilation from CBN statistical bulletin (various issues) and national bureau of statistics (2014). Consumer price index was used as a proxy for inflation.

Apparently, CS is caused by two main factors- high inflation and exchange rate depreciation (Zamarocksy and Sa, 2003; and Ra, 2008). High inflation rate and exchange rate depreciation often lead to increase in CS and they are assumed to move in the same direction in Nigeria (see Table 2). In Table 2, CS reached its peak of 22.4% in 2013 and which was the highest inflation and exchange rate period in Nigeria. And the growth rate of real GDP was 6.9. No significant effort have be achieved by Nigeria government to reduce the rise of CS. Though the growth rate of GDP fluctuated slightly within the period, sound macroeconomic policy action that will lower the holding of FCD and increase preference for national currency as well as addressing the continuous rise in inflation and exchange rate need to be put in place. By this, CS will reduce and higher growth rate of real GDP will be achieved. Figure 1 shows the trends of CS, inflation, exchange rate and growth rate of real GDP. It explained the relationship and movement between these selected macroeconomic variables in Nigeria.

Figure 1: Trends of CS, inflation, exchange rate and growth rate of real GDP



Source: Author's compilation

2.5 Currency Substitution: Empirical Review and Theoretical Evidence

2.5.1 Empirical Review

This section presents the various studies carried out, the methods used, the countries of research and the results obtained. The section helps in identifying the variables to be included in the model of this study. A large number of studies have investigated the presence of CS in the economy, focusing particularly on the dynamics, causes and effect on macroeconomic variables (see, for example, Viseth, 2001; Doguwa, 2014; Feige, 2003; Dallas, Balter and Hafer, 1985; Xaiyavong, 2015; etc.). However, there are fewer studies on the impact of CS on economic growth, particularly in Nigeria (see, for instance, Oziengbe, 2015). Most studies in extant literature consider CS in the framework of demand for money.

For purposes of precision, the study summarises existing literatures on CS in Table 3 below.

Table 3: Impact of CS on macroeconomic variables

Author & Year of study	Estimation Period	Estimation Method	Measure for CS	Country of study	Results Obtained
Adom, et al (2009)	1976-2005	Ordinary Least Squared (OLS)	M2	Nigeria	CS was prevalent
Bahmani-Oskooee and Techaratanachai (2001)		Johansen and Juselius co-integration technique,	M2	Thailand	CS was prevalent
Doguwa (2014)	1994-2014	partial adjustment and autoregressive distributed lag models	Foreign currency deposits/Naira demand deposit ratio	Nigeria	Macroeconomic policies lead to higher degree of CS
Fielding and Shorthand (2002)	1981-1996	OLS & ML	Ratio of stock of financial asset	Egypt	Political violence causes increase in the rate of currency substitution.
Asel (2009)	2000 - 2008	Generalized Method of Moments GMM		Kazakhstan, Kyrgyz republic and Tajikistan.	currency substitution decreases governments' seigniorage revenue,
Mizen, Pentecost (1994)	1976-1990	OLS	Pound sterling held in European Countries	Europe	No prevalence of CS
Melvin (1985)	1972-1980	OLS & Sensitivity Analysis	M1	Ilra	Prevalent of CS
Brillenbourg, Schadler (1979)	1973 – 1978	Full Information Maximum Likelihood	M2	France	CS prevalent
Balten, Hafer (1985)	1972-1983	OLS	M2		No effect
Artis, Bladen & Zhang (1993)	1979-1990	OLS	M1	Italy	CS prevalent
Monticelli (1993)	1979-1992	ECM, Granger Causality	Europe-wide Money Stock Aggregate	Selected Europeans Countries	Minor eefect
Augeloni, et al	1982-1990	GLS	M1, M3		No effect of CS

Source: Author's compilation from reviewed literature

Noted in Table 2, most of the previous work on CS was basically carried out using OLS and other estimation techniques especially for studies on Nigeria. In the present study, however, the study employs a more comprehensive/robust analysis using VAR model. With this, the present study represents an improvement on those in extant literature. However, several authors have also used the VAR model in this area. For instance, Rojas-Suarez (1992) analyses the process of CS and its implications for the conduct of monetary policy in Peru from January 1978 to December 1990. Applying VAR model, the author tests for the impact of CS on inflation. The results show that CS affects inflation in a relatively small magnitude especially in a period of high but relatively stable inflation.

Another author, Prock, et al. (2003) investigate the extent of currency substitution in Argentina, Brazil, and Mexico using monthly data from 1986 to 2001. Applying a vector error correction (VEC) model for each country, they find that Argentina has the highest magnitude of exchange rate coefficients and Mexico had the lowest. The lags of money supply was significant only for Argentina and Brazil for which the magnitudes of the M1 lags are highest in absolute value. The results from the impulse response functions show that the impact of the exchange rate on M1 for Argentina is greater than Brazil and Mexico. Furthermore, the M1 response to exchange rate for Argentina is faster and last longer than that for Brazil and Mexico. At the end, the authors conclude that CS occurs more in Argentina and Brazil than Mexico.

2.5.2 Theoretical Review

Theoretical framework on CS is often linked to the theories of demand for money. For instance, in 1986, Poloz, used the theory of the precautionary demand for cash balances to estimate the determinants of CS. Miles (1978), used the money services production function approach. Other authors like Brillembourg and Shadier (1979), used the portfolio balance approach. Somewhat some other authors use the marginal utility theory of money demand (Bordo and Choudhri, 1982; and Rojas-Suarez, 1992). Similarly, many authors have also used the money-in-the-utility function model to study substitution between domestic and foreign currencies in different countries (Bufman and Leiderman, 1993; Imrohoroglu, 1994; Verbestki and Friedman, 2001 and Selcuk, 2006).

As regards the theories of demand for money, Xaiyavong (2015) is of the view that the main determinants of CS are actual or expected reductions in the value of domestic money holdings occasioned by increased domestic inflationary pressures, expectations of exchange rate depreciations, and lower interest rates on local currency holdings. By altering the relative yield to holdings of foreign

currency denominated money balances, and therefore their attractiveness as a store of value, these factors induce a change in the pace of CS. This process may be further affected by uncertainties regarding socio-political developments, as well as those relating to agents' expenditure patterns.

In the current study, since growth is the object to which CS is being assay, it is therefore imperative to discuss growth theory in brief. Broadly speaking, several empirical studies coupled with theories have proven that economic growth is determined by several factors. Thus most growth models are adjusted to create allowance for policy variables. From the growth-theory literature point of view, capital, labour and technological expansion are the key factor influencing economic growth. This hypothesis is evidence in the Solow-Swan model. The Solow-Swan model of economic growth postulates a continuous production function linking output to the inputs of capital and labour which leads to the steady state equilibrium of the economy. Given certain assumptions, Solow shows in his model that with variable technical coefficient, there would be a tendency for capital-labour ratio to adjust itself through time in the direction of equilibrium. If the initial ratio of capital to labour is more, capital and output would grow more slowly than labour force and vice versa. Solow's analysis is convergent to equilibrium path (steady state) to start with any capital-labour ratio. Thus, the long run steady impact of CS on economic growth can be examined with the Solow augmented growth model. For more on the mathematical postulate see Solow-Swan (1956).

In conclusion, in the empirical and theoretical framework above, exchange rate, inflation and interest rate appear to determine CS. Also, evidence have shown that CS is present in most of the transitional economies investigated in spite of the approach utilised. The results of empirical review also indicate that macroeconomic policies lead to higher degree of CS and that CS affect a country's ability to effectively conduct sound monetary and fiscal policies, that is, CS weaken the ability of the national monetary authority to implement sound monetary policy.

3.0 The Model, Methodology and Data

In line with the theoretical framework in the previous section and following Rojes-Suarez (1992) and Prock, et al (2003), a system estimator is used to estimate the relationships, in the form of a vector autoregressive (VAR) model. VAR considers all variables as endogenous, to estimate and provide empirical evidence on the dynamic nature of the effects of CS on economic growth in Nigeria. A three-variable-VAR-model is specified. The variables for the study are: growth rate of

real GDP (GRY), inflation rate (INF) and currency substitution (CSUB) which was explained in section II. First, specify the system of equations functionally as:

LCSUB = *f* (LGRY, LINF)………………………………….. (1)

LGRY = *f* (LINF, LCSUB) ………………………………… (2)

LINF = *f* (CSUB, LGRY) ………………………………… (3)

Where: LCSUB = log of currency substitution and LGRY= log of growth rate of income and f shows functional relation between the explanatory and explained variables.

Second, in terms of matrix algebra notations the following equation shows the mechanism of the VAR model:

$$\Delta Y_t = \propto_1 \Delta Y_{t-1} + \ldots + \propto_p \Delta Y_{t-p} + \beta \Delta X_{t-1} + \varepsilon_t \qquad (4)$$

Where Y_t is a vector of non-stationary I(1) variables, X_t is a vector of deterministic variables, $\propto_1 \ldots \propto_p$ and β are matrics of coefficients to be estimated and ε_t is the vector of innovations that have zero means, constant variances and may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right hand side variables. In order to analyse the impact of unanticipated shocks on the macro variables in a more convenient and comprehensive way, Sims (1980) proposes the use of impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). The IRFs trace the reaction of all the variables in the VAR system to innovations in one of the variables and therefore can be used to analyze the effects of structural innovations. A shock to one variable not only directly affects that variable, but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. If the innovations are contemporaneously uncorrelated, interpretation of the impulse response is straightforward. The ith innovation is simply a shock to the ith endogenous variable. Innovations, however, are usually correlated, and may be viewed as having a common component, which cannot be associated with a specific variable, which is however taken care off with the so-called Cholesky decomposition. It is important to note, that IRFs are a conceptual experiment. FEVDs represent the decomposition of forecast error variances and therefore give estimates of the contributions of distinct innovations to the variances. Thus, they can be interpreted as showing the portion of variances in the prediction for each variable in the system that is attributable to its own innovations and to shocks to other variables in the system. With these estimation tools we would be able to observe the effect or behaviour of CS when economic growth vacillates.

The data for this study are obtained from the Central Bank of Nigeria (CBN) *statistical bulletin* and the National Bureau of Statistics (Various Issues). The data span through 19 years, that is, from 1995 to 2013. This is the period for which CS data are readily available.

4.0 Analysis of Results

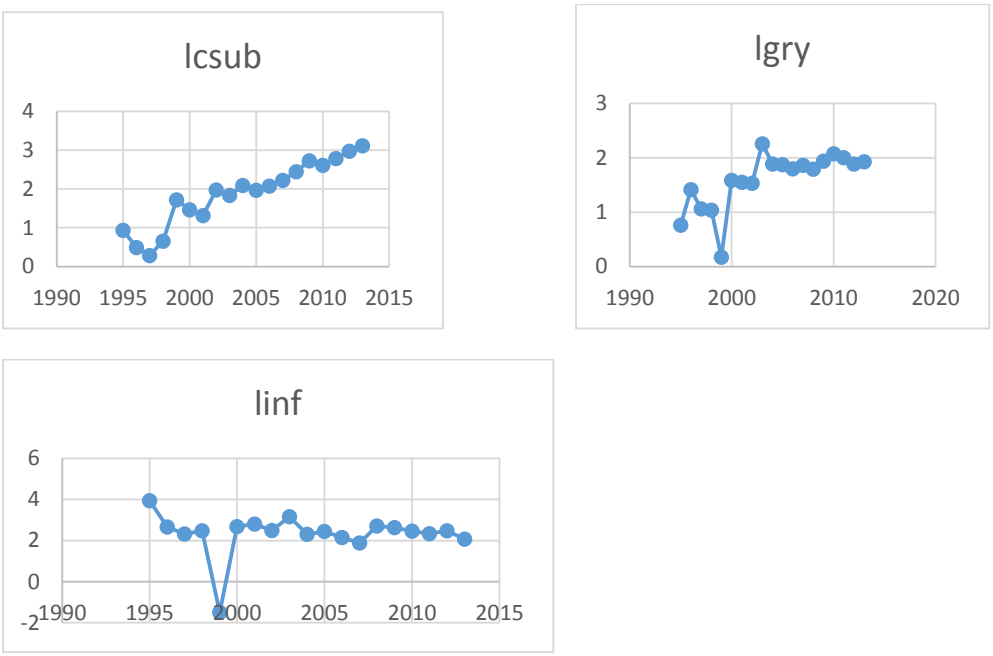
This section begins with trend analysis and summary descriptive statistics. What follows is a unit root test of the relevant variables using the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. Then the study applies the Johansen co-integration tests to investigate the long run equilibrium relationship of the dependent variable and the independent variables. The pairwise granger causality tests are also estimated. The short-run dynamic properties of the variables are analysed using the forecast error variance decompositions and generalized impulse response analysis. Finally, it discusses the findings and draw some policy implications based on the empirical results obtained. Some tests are also conducted for stability of the results.

4.1 Trend Analysis

First, the study begins by analysing the trend pattern of each of the series over time. Figure 2 below presents the plots of the time series. In the chart, the logarithms of the variables are used. It can be seen that inflation seems to have deeper swings than CS and real GDP growth although the fluctuations in real GDP growth appear to be more frequent. The trend in their overall movements also appears to be similar in the charts. Apparently in the charts, the trends of the series seem to be non-stationary over time especially with the presence of irregular movements thus having effects on the behaviour of the series and thus making it difficult to easily assess the stationarity properties.

However, since it is difficult to assay the stationarity status of the series as seen in the charts in Figure 2, therefore it is necessary to conduct a general examination on the unit roots properties of the series to enable the study draw a plausible policy conclusion on the series. In this regard, ADF and the PP test are conducted.

Figure 2: Logarithmic trends of CS, Real GDP growth and Inflation in Nigeria



Source: Author's computation. L = logarithms of the variables

4.2: Summary of Descriptive Statistics Results

Table 4: Summary of Descriptive Statistics

	LGRY	LCSUB	LINF
Mean	1.601583	1.879466	2.344489
Median	1.796917	1.979669	2.477624
Maximum	2.258633	3.111030	3.943353
Minimum	0.173953	0.287174	-1.497868
Std. Dev.	0.516842	0.839511	1.028877
Skewness	-1.327207	-0.426862	-2.722614
Kurtosis	4.228529	2.194725	11.78024
Jarque-Bera	6.772864	1.090372	84.50504
Probability	0.033829	0.579734	0.000000
Observations	19	19	19

Source: Author's computation using E-views 7.0

Table 4 reports the summary of the descriptive statistics of log of CS, inflation and growth rate of GDP. In the results, normality test uses the null hypothesis of normality against the alternative hypothesis of non-normality. According to the test, if the probability value is less than the Jacque Bera chi-square at the 5% level

of significance, the null hypothesis of the regression is not rejected. Given the results in Table 4, it is obvious that the hypothesis that all the variables are normally distributed cannot be rejected. Since all the probabilities are less than the Jarque Bera chi-square distribution, the variables pass the test of significance at 1 percent level except for the log of CS. Hence, the variables are normally distributed.

Measuring the direction and degree of asymmetry for all the variables, the coefficient of skewness indicates that all the variables are negatively skewed. That is, the distribution of the series around its mean has values less than zero which indicates that the series are skewed to the left. This suggests that the distribution has a long left tail. But the positive coefficients of the kurtosis indicate that the distribution is quite peaked since there are very few cases in the tail of the distribution. On the whole, the incorporated variables in the study are normally distributed.

4.3 Unit Roots Test

The results of the unit roots test, using both the ADF and PP test are presented in Table 5.

Table 5: Results of stationarity tests on LCSUB, LINF & LGRY

Variables (L = log)	ADF Test			PP Test		
	Level	**1st Difference**	**Order of Integration/ Remark**	**Level**	**1st Difference**	**Order of Integration/ Remark**
LCS	-3.704	-5.585*	I(1)/ Stationary	-3.642	-5.746*	I(1)/ Stationary
LGRY	-2.033	-3.817**	I(1)/ Stationary	-3.196	-6.914*	I(1)/ Stationary
LINF	-3.249	-4.226*	I(1)/ Stationary	-4.549**	-7.187*	I(1)/ Stationary

ADF critical values: 1% (-4.671) & 5% (-3.735). PP critical values: 1% (-4.619) & 5%(-3.711)

Source: Author's Computation using E-Views 7.0

Empirical results from both ADF and PP tests show that the null hypothesis of a unit root test cannot be rejected at the 5 per cent level for all the variables used in the study, except for the log of inflation (LINF) that is level stationary, I(0) under PP test. All the other variables in Table 5 are integrated of order 1, that is, I (1). This means that all the variables, using either ADF or PP test, are different stationary and this suggests a short run disequilibrium. Also, since all the variables are not level stationary, therefore, there is need to correct for short-run disequilibrium.

Table 6: VAR Lag Selection Criteria

Endogenous variables: LGRY LCSUB LINF

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-36.43924	NA	0.020789	4.639910	4.786948	4.654526
1	-8.920638	42.08727*	0.002417*	2.461252*	3.049402*	2.519715*
2	-0.076306	10.40510	0.002800	2.479565	3.508829	2.581876

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

Source: Author's Computation using E-Views 7.0

The results in Table 6 represent the outcome of the VAR lag selection criteria. The results suggest that all the selection criteria: the sequential modified LR test statistic (LR), Final Prediction error (FPE), Akaike information criterion (AIC), Schwarz information criteria (SC), and the Hannan-Quinn information criteria (HQ), choose the optimum lag length of 1 indicating that the optimum lag to be used for the estimation is 1.

4.4 Johansen Cointegration Test

Cointegration is basically employed in empirical analysis especially where the variables used in a study are not level stationary. The existence of cointegration implies that the time series variables must be drifting together at roughly the same rate, that is, they are linked in a common long-run equilibrium or are cointegrated. This study uses Johansen cointegration because the study involves the use of multivariate estimations. However, in the event that long-run relationship or equilibrium does not exist among the variables, the best or appropriate technique will be VAR mechanism. The results of the Johansen tests are presented in Table 7.

Table 7: Johansen cointegration results

Sample: 1995 2013
Included observations: 17
Test assumption: Linear deterministic trend in the data
Series: LINF LGRY LCSUB
Lags interval: 1 to 1

Eigenvalue	Likelihood	5 Percent	1 Percent	Hypothesized
0.668148	26.18579	29.68	35.65	None
0.254216	7.433681	15.41	20.04	At most 1
0.134074	2.447251	3.76	6.65	At most 2

*(**) denotes rejection of the hypothesis at 5% (1%) significance level

L.R. rejects any cointegration at 5% significance level
Source: Author's Computation using E-Views 7.0

In the Johansen results presented in Table 7, and having seen that the data are trendy, the results suggest that the study cannot reject the hypothesis of no linear relationship between the variables in the VAR model at 5% level. That is, a long run equilibrium relationship does not exist between the variables. Thus, the series are not cointegrated. So having satisfied that the variables in the VAR model are not cointegrated, thus the use of VAR method is justified in the study, and otherwise, the use of VECM would have been appropriate. Therefore, VAR analysis is what follows.

4.5 Pairwise Granger Causality Tests

Table 8: Pairwise Granger Causality Tests (Lags: 2).

Sample: 1995 2013

Null Hypothesis:	Obs	F-Statistic	Probability
LINF does not Granger Cause LCSUB	17	1.16847	0.34384
LCSUB does not Granger Cause LINF		1.82231	0.20366
LGRY does not Granger Cause LCSUB	17	1.14550	0.35052
LCSUB does not Granger Cause LGRY		5.26455	0.02284
LGRY does not Granger Cause LINF	17	1.48835	0.26460
LINF does not Granger Cause LGRY		3.93346	0.04856

Source: Author's computation using E-Views 7.0

The results of the pairwise granger causality tests are reported in Table 8. Apparently, the results indicate that a strong uni-directional causality runs from log of CS to log of GRY. This result is also true of the granger causality tests where lag 1 is used (see the results in appendix 1). In the same way, a uni-directional causality also runs from log of inflation to log of GRY. The results imply that CS and inflation impact strongly on economic growth in the period under review.

4.6 VAR Analysis

The VAR model provides information about the direction of the impact and the relative importance of variables that simultaneously influence each other. The main purpose of using the VAR model is to analyse the impact of dynamics of random disturbances on the system. Here the study presents the VAR estimates, the results of the impulse response function and the variance decompositions. The results of the VAR estimates are presented first and then followed by impulse response function and the variance decompositions analysis.

Table 9: Vector Autoregressive Estimates
Sample(adjusted): 1997 2013
Standard errors & t-statistics in parentheses

	LGRY	**LCSUB**	**LINF**
LGRY(-1)	0.621664	-0.493118	0.559044
	(0.67641)	(0.61291)	(2.12615)
	(0.91907)	(-0.80455)	(0.26294)
LGRY(-2)	-0.103584	0.548465	-0.350884
	(0.32500)	(0.29450)	(1.02158)
	(-0.31872)	(1.86239)	(-0.34347)
LCSUB(-1)	0.427694	0.887468	-0.645693
	(0.37237)	(0.33742)	(1.17047)
	(1.14857)	(2.63020)	(-0.55165)
LCSUB(-2)	-0.107187	-0.098598	1.196454
	(0.48661)	(0.44093)	(1.52957)
	(-0.22027)	(-0.22361)	(0.78221)
LINF(-1)	-0.176380	0.258561	-0.578742
	(0.21043)	(0.19067)	(0.66143)
	(-0.83820)	(1.35604)	(-0.87498)
LINF(-2)	0.022697	-0.123255	0.061587
	(0.11863)	(0.10749)	(0.37288)
	(0.19133)	(-1.14665)	(0.16517)
C	0.546074	0.184967	2.153439
	(0.42108)	(0.38155)	(1.32357)
	(1.29685)	(0.48478)	(1.62699)
R-squared	0.697064	0.895655	0.257466
Adj. R-squared	0.515302	0.833048	-0.188054
Sum sq. resids	1.216123	0.998522	12.01569
S.E. equation	0.348730	0.315994	1.096161
F-statistic	3.835037	14.30601	0.577899
Log likelihood	-1.702821	-0.027067	-21.17246
Akaike AIC	1.023861	0.826714	3.314407
Schwarz SC	1.366949	1.169802	3.657494
Mean dependent	1.661549	2.016179	2.231805

S.D. dependent	0.500902	0.773363	1.005672
Determinant Residual Covariance		0.000203	
Log Likelihood		-0.076306	
Akaike Information Criteria		2.479565	
Schwarz Criteria		3.508829	

Source: Author's computation using E-Views 7.0

The VAR estimation results reported in Table 9 and appendix 2, throw more light on the granger causality test results. In the VAR estimation results reported in appendix 1 (using lag length of 1) LCSUB apparently had a significant impact on LGRY at 5% level of significance. This result is slightly different from the result reported in Table 9. Just that the impact of LCSUB (-1) on LGRY may have passed the significant test at 10% level of significance. In all, CS is found to have impacted on economic growth and the LCSUB (-2) shows a negative relationship with LGRY. It follows therefore that LCSUB was the main variable that explained LCSUB. Log of Inflation (-1) has a negative impact on economic growth and a positive impact on CS as evident in Table 9.

4.7 Impulse Response Function

Table 10a: Generalised Impulse Responses to one SE shock in the equation for LGRY

Horizon	LGRY	LCSUB	LINFL
0	.34873	-.22174	1.0153
1	-.057116	-.10624	-.24945
2	-.026261	-.042627	-.14410
3	.0025023	-.052244	-.026195
4	-.012150	-.046811	-.3686E-3
5	-.022763	-.025895	-.041353

Source: Author's Computation using E-Views 7.0

Fig 3a: Graph of IRF of LGRY

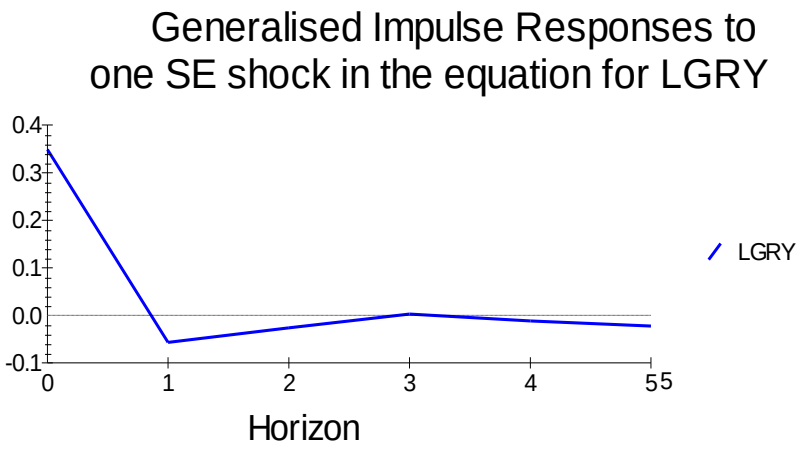


Table 10b: Generalised Impulse Responses to one SE shock in the equation for LCSUB

Horizon	LGRY	LCSUB	LINFL
0	-.24471	.31599	-.78142
1	.12085	.19906	.11140
2	.11436	.076815	.29037
3	.021404	.11978	.048909
4	.042420	.12775	-.024019
5	.071299	.080147	.093941

Source: Author's Computation using E-Views 7.0

Fig 3b: Graph of IRF of LCSUB

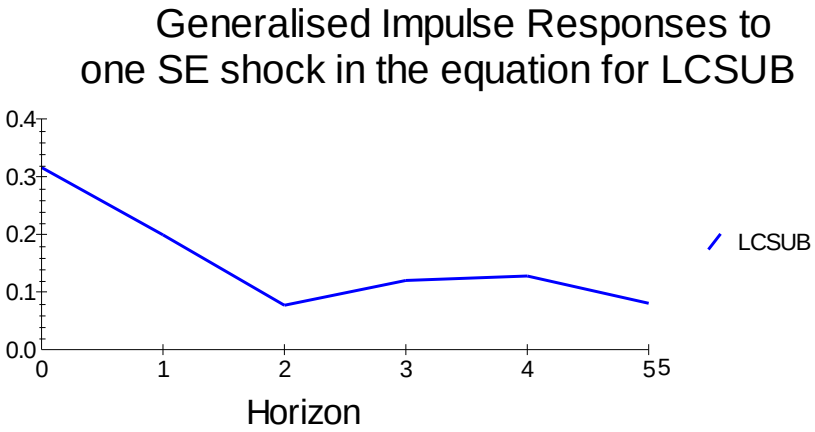
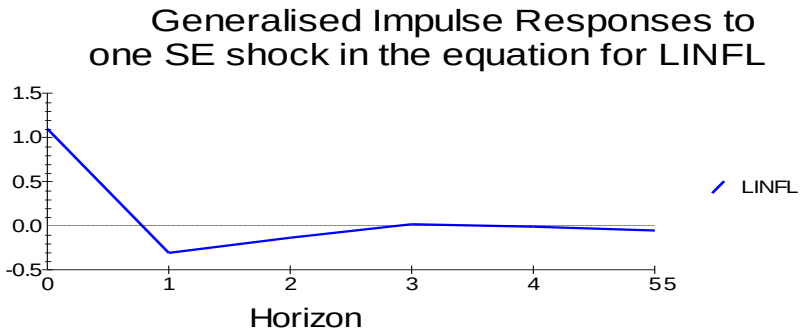


Table 10c: Generalised Impulse Responses to one SE shock in the equation for LINFL

Horizon	LGRY	LCSUB	LINFL
0	.32299	-.22526	1.0962
1	-.088890	-.075763	-.30838
2	-.017704	-.038884	-.13764
3	.0069702	-.064641	.016421
4	-.023332	-.045470	-.012656
5	-.025140	-.023947	-.055134

Source: Author's Computation using E-Views 7.0

Fig 3c: Graph of IRF of LINFL



Actually, the study is interested in examining the impact of the consequences of introducing a shock to the system. As the IRF analysis indicates, observe that in Table 10a, one positive shock to growth rate of income in logarithmic form (LGRY) leads to negative response to itself in the first and second periods. In the third period it becomes positive and later fizzles out in periods 4 and 5. Meanwhile, the shock or innovation to LGRY from currency substitution in log form (LCSUB) and inflation rate in logarithmic form (LINFL) produce continuous negative responses from period one to five. Figure 3a shows the IRF of LGRY to itself. In the second Table (Table 10b), a positive shock/innovation from LCSUB to itself produces a positive response all through the periods. This is clearly seen in Figure 3b. Also Table 10b shows the reaction of LCSUB as a result of shock or innovation in LGRY and LINFL respectively. The IRF reveals that the shock or innovation in LGRY will cause LCSUB to respond positively all through the periods though negative in the initial period. Shock in inflation rate (LINFL), however, causes LCSUB to respond positively in the first three periods. In the fourth period it reacts negatively but later becomes positive in the fifth period. The reaction of inflation rate (LINFL) to innovations in

LGRY and LCSUB, respectively is reported in Table 10c while Figure 3c shows the IRF of LINFL to itself. From figure 3c, LINFL responded negatively to the shock/innovation from itself. In addition, LINFL reacts negatively to the positive shock/innovation from LGRY and LCSUB all through the periods except for LGRY in the third period which is also negligible showing a response of 0.6 percent.

In summary, the results of the IRFs support the previous argument that high inflation rate tends to encourage countries especially developing economies to adopt CS. This finding corroborates the finding of Rojas-Suarez (1992) which conclude that- CS affects inflation in a relatively small magnitude especially in a period of high but relatively stable inflation. It also is in sync with the findings of Asel (2009). The result of IRF for economic growth, CS and inflation are quite significant, showing apparently that CS impacts positively on economic growth during period of low and falling inflation.

4.8 Variance Decomposition

Variance decomposition measures the proportion or portion of forecast error variance in one variable explained by innovations in itself and the other variables. Table 8 below shows the salient results from the variance decomposition technique. In general, the results reveal that own shock constitutes the predominant source of variations for all the variables in the VAR model.

Table 11a: Generalised Forecast Error Variance Decomposition for variable LGRY

Horizon	LGRY	LCSUB	LINFL
0	1.0000	.49240	.85785
1	.87479	.52180	.78618
2	.76508	.53354	.68572
3	.75826	.53153	.67987
4	.74621	.53314	.67151
5	.72101	.54206	.64978

Source: Author's Computation using E-Views 7.0

Table 11b: Generalised Forecast Error Variance Decomposition for variable LCSUB

Horizon	LGRY	LCSUB	LINFL
0	.49240	1.00000	.50818
1	.39650	.91477	.37045
2	.39182	.91473	.36491
3	.37031	.90994	.35420
4	.34254	.89745	.32749
5	.33129	.89077	.31641

Source: Author's Computation using E-Views 7.0

Table 11c: Generalised Forecast Error Variance Decomposition for variable LINFL

Horizon	LGRY	LCSUB	LINFL
0	.85785	.50818	1.00000
1	.82438	.46991	.97799
2	.78437	.49815	.92653
3	.77544	.49384	.91560
4	.77387	.49324	.91386
5	.76940	.49572	.90929

Source: Author's Computation using E-Views 7.0

The variance decomposition estimates suggest that shocks to logarithmic economic growth rate (LGRY) as shown in Table 11a, explained about 52.1 percent of shocks in CS in log form (LCSUB) in the 1st quarter, increasing in effects to about 53.1 percent in the 3rd quarter and rising further to 54.2 in the 5th quarter. These results indicate a sustained impact of CS on economic growth in Nigeria especially during period of high and rising inflation. This finding is also very significant because the response of LCSUB is faster and lasts longer during period of high and rising inflation. Similarly, shocks to economic growth explain about 78.6 percent shocks in inflation in the first quarter, and decline all through the quarters, to 64.9 percent in the fifth quarter. This result clearly shows that economic growth and the rise in general price level move in opposite direction thus affirming the a priori expectation of a negative relationship between economic growth and inflation.

As evidenced in Table 11b, shocks to LSCUB explain about 39.6 percent of shocks in economic growth in the first quarter and fall to 33.1 percent in the fifth quarter. This result is the same as the shocks of LCSUB to shocks in inflation. In Table 11b, shocks to inflation decline to 31.6 percent in the fifth quarter. One major conclusion that can be deduced from this finding is that during period of high inflation, currency substitution tends to impact negatively on economic growth. In other words, CS is more pronounced during period of high inflation, and vice versa.

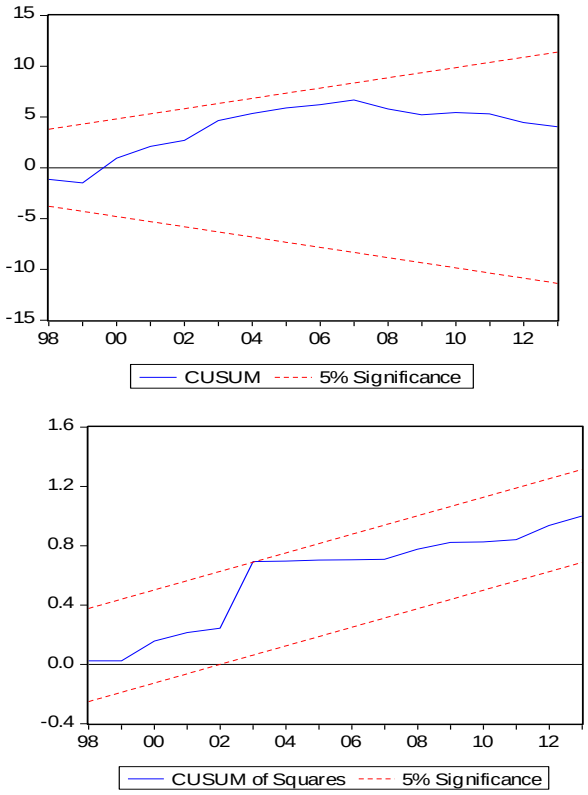
Table 11c shows the impact of shocks in inflation to shocks in economic growth and CS. As noted in the table, shocks to inflation contribute about 82.4 percent shocks to economic growth in the first quarter, falling to about 77.5 percent in the third quarter, and to 76.9 percent in the fifth quarter. The result demonstrates a negative and significant relationship between inflation and economic growth in Nigeria. The implication of this finding is that inflation shock greatly affects economic growth in Nigeria and explain the reason for CS. The contribution of

shocks in inflation to shocks in CS shows a positive trend. In the first quarter, shocks to inflation explain about 46.9 percent shock in LCSUB. This rises to 49.3 percent in the third quarter and stands eventually at 49.5 percent in the fifth quarter. This clearly shows that inflation and CS move in the same direction. As evidence in this result, periods of high and rising inflation drive and encourage CS thus affecting economic growth negatively and significantly.

4.9 Stability Test.

Having achieved the objective(s) of this study in line with the empirical findings using VAR model, it remains to test for the reliability and stability of the model. Here the study used both cumulative sum (CUSUM) and cumulative sum squared (CUSUM squared) test. The results obtained are reported in Figure 4 below.

Figure 4: CUSUM and CUSUM-sq Test

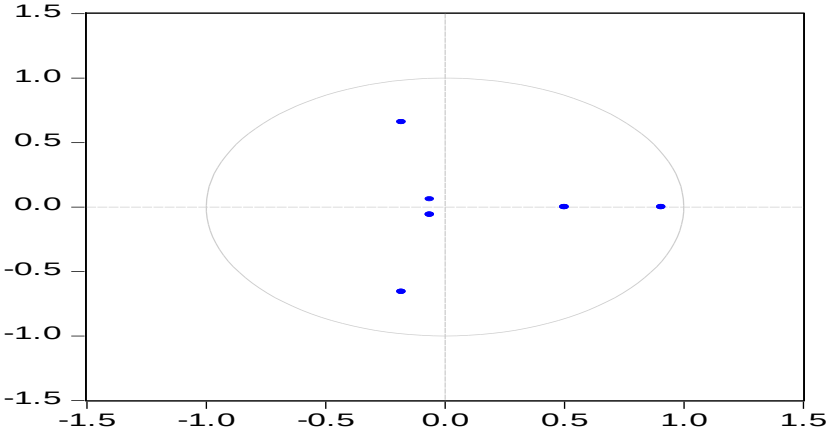


Source: Author's Computation using E-Views 7.0

Figure 4 above shows CUSUM (cumulative sum) and CUSUM-sq (CUSUM squared) test for economic growth (GRY) model. CUSUM and CUSUM-sq test do not exceed the critical boundaries at 5% level of confidence as displaced in the figures. This implies that the model of economic growth (proxied by growth rate of GDP) is accurately specified and long run coefficients are meaningful and reliable for policy decision. To underscore the stability test, the inverse roots of AR is carried out. This is presented in Figure 5 below.

4.10 Inverse Roots of AR

Figure 5: Inverse Roots of AR Characteristic Polynomial



Source: Author's Computation using E-Views 7.0

Figure 5 shows the results of the inverse roots of AR. As it can be observed in the figure none of the polynomial roots are found outside the circle. This suggests that the impulse response functions of the estimated VAR are stable, thus, can be used as a basis for policy stance.

5.0 Conclusion

The study has attempted to investigate the impact of CS on economic growth in Nigeria using VAR approach, in the sample period 1995 through 2013. Interestingly, the results obtained from the estimation exercise are quite revealing. First, the series are first difference stationary at 5% level using both ADF and PP test but fail to achieve long-run equilibrium/relationship using Johansen co-integration test; hence the choice of VAR becomes handy and appropriate. More so, the results of IRFs and variance decomposition show that inflation impacts economic growth in a negative (and significant) way. The second most important findings of the study, as revealed by IRFs and FEVDs results, are the

response and the shock of CS to economic growth (LGRY). LGRY responds positively to the innovations in CS especially during period of low and falling inflation. Also, positive shocks to CS have a significant impact on shocks in economic growth in Nigeria. Apparently, CS affects economic growth negatively (and significantly) during period of high and rising inflation and vice versa. In other words, CS is present and has significant impact on economic growth in Nigeria especially during period of high and rising inflation. This is so, because majority of economic agents in the country will try as much as possible to substitute foreign currency for national one when the value of the national currency continues to be eroded by inflation, thus eroding the preferences for national currency. This will impinge on exchange rate negatively through demand and supply forces. It is therefore recommended that efforts should be made by government through the monetary and fiscal authorities to curb high and rising inflation by employing a mix of optimum monetary and fiscal policy.

These results are tentative, having regard to the weaknesses in data and VAR model used and the non-recognition of the impact of the global economic crises of 2008 – 2009 on parameter estimates. Even so, those lapses are not such as to nullify the conclusions reached in the light of the study's robust goodness – of – fit statistics.

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APPENDIX 1:

Pairwise Granger Causality Tests
Sample: 1995 2013
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
LINF does not Granger Cause LCSUB	18	0.15815	0.69647
LCSUB does not Granger Cause LINF		1.41519	0.25269
LGRY does not Granger Cause LCSUB	18	1.47610	0.24317
LCSUB does not Granger Cause LGRY		15.7792	0.00123
LGRY does not Granger Cause LINF	18	0.62496	0.44153
LINF does not Granger Cause LGRY		2.61699	0.12656

APPENDIX 2:

Vector Autoregressive Estimates

Sample(adjusted): 1996 2013
Included observations: 18 after adjusting endpoints
Standard errors & t-statistics in parentheses

	LGRY	LCSUB	LINF
LGRY(-1)	0.044607	0.377408	-0.121074
	(0.25745)	(0.29783)	(0.84432)
	(0.17326)	(1.26719)	(-0.14340)
LCSUB(-1)	0.474864	0.774460	0.410187
	(0.14642)	(0.16939)	(0.48020)
	(3.24308)	(4.57207)	(0.85419)
LINF(-1)	0.018464	-0.070224	0.009070
	(0.10153)	(0.11746)	(0.33298)
	(0.18186)	(-0.59787)	(0.02724)
C	0.673845	0.097249	1.683098
	(0.26678)	(0.30863)	(0.87493)
	(2.52581)	(0.31510)	(1.92369)
R-squared	0.660089	0.842446	0.090202
Adj. R-squared	0.587251	0.808684	-0.104754
Sum sq. resids	1.383555	1.851600	14.88083
S.E. equation	0.314365	0.363672	1.030978
F-statistic	9.062409	24.95278	0.462678
Log likelihood	-2.449456	-5.071998	-23.82821
Akaike AIC	0.716606	1.008000	3.092023
Schwarz SC	0.914467	1.205860	3.289884
Mean dependent	1.648034	1.931722	2.255663
S.D. dependent	0.489318	0.831446	0.980882
Determinant Residual Covariance		0.000651	
Log Likelihood		-10.58840	
Akaike Information Criteria		2.509822	
Schwarz Criteria		3.103403	