Savings, Gross Capital Formation and Economic Growth Nexus in Nigeria (1975-2008)

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Abstract: *This paper investigated the relationship among savings, gross capital formation and economic growth in the Nigeria economy, between 1975 and 2008. The study adopted co-integration and vector error correction model VECM as the estimating technique with special reference to VAR causality test. The result of unit root i.e. stationary test showed that the gross domestic product GDP which is a proxy for growth, savings which is a proxy for gross national savings GNS are both integrated of order two i.e. 1 (2) while capital formation which gross capital formation GCF served as its proxy is integrated of order 1 (1)   The findings revealed the existence of long run relationship among the three variables as shown from the co-integration regressions which were characterized by high R square, positive coefficient from all parameter estimates and significant of F values from all the three equations. The vector error correction model, apart from corroborating the strong linkage among the three variables, also showed that GDP has stronger influence on both GNS and GCF than the influence of GNS and GCF have on GDP .Also causality test confirmed the existence of the symbiotic relationship among them since GDP and GCF, GDP and GNS, and GNS and GCF all exhibit bidirectional causality. If the findings of this research work are transformed into policy implementation i.e. proper harmonization of policies on economic variables, development of the real sector of economy, acceleration of the growth of capital formation, grass root mobilization of savings from the surplus sector to deficit sector, it will lead to a sustained long run economic growth.*
Key Words: Gross National Savings, Gross Capital Formation and Gross Domestic Product.JEL Classification: O11 and O243

I.   Introduction

It is established in economic theory that high savings, coupled with high levels of capital formation are prerequisites for long-term economic growth in any given country (Lewis 1954, 1955). High levels of savings are necessary to finance high levels of capital formation, which will lead to increased productivity and ultimately long-term economic growth. A country cannot be totally dependent on foreign investment to finance capital formation.

In the late 1970s and early 1980s, most developing countries of Africa (including Nigeria) experienced unprecedented and severe economic crisis. This crisis manifested in several ways such as persistent macroeconomic imbalance, widening savings-investment gap, high rates of domestic inflation, chronic balance of payment problems and huge budget deficit. Although different reasons have been adduced for the slowdown of these economies, some literatures attributed the problem to the decline in investment rates in the economies.

The early Harrod-Domar models specified investment as the key to promoting economic growth. This was challenged by the Neo-Classical Solo (1970), model in 1950s. Solo model argues that savings importantly contribute to economic growth and policies therefore need to be directed to increasing domestic savings.

In Nigeria, the level of investment and savings have been very low. This low level of investment cum savings, as Iyoha (1998) observed among others was one of the main cause of the negative real GDP growth and a decline in per capita GNS in the early and mid-1980s.

Nigeria as a developing economy is faced with different economic problems which are directly linked with fluctuations in the major macro-economic variables (Odoko, 2003). The tendency of establishing or finding the correct relationship among the major macro-economic variables such as gross output (GDP), Gross Capital Formation, savings, exchange rate, inflationary rate, employment rate to mention a few and their right applications in policy implementation has been the secret of economic growth of many developed economy.

Past empirical   works on the relationship among economic growth, investment and savings especially in Nigeria appear to be one sided, in that they all focused on studying the impact of one economic variable on the other or the determinants of one of these three variables. Examples of these researchers are Nwachukwu and Festus (2007), Pahlavani (2006), Ogun and Obembe (2006), Olufemi (2008), Kriechaus (2002), among others. These empirical works confirmed the likelihood of having a kind of diverse forms of relationship among the three macro-economic indicators hence the need to critically examine these forms of relationship without restriction on the direction of causality. This will guide in formulating policy that will positively influence them

and transform the influence to the overall economic development of the country. This is the basis for this research work.

The broad objective of this study is to examine the relationship among economic growth, gross capital formation and savings in Nigeria between 1975 and 2008

II. Some Literature

Pahlavani et al (2006) carried out some research works on the role of capital formation and savings in promoting economic growth in Iran. He made use of time series data spanning from 1960 to 2003. This paper estimated the interdependence among real capital formation, saving and output for Iran in those turbulent years of 1960 to 2003.

Verma and Wilson (2005) investigated the relationship among savings investment and growth in India. The researchers made use of time series data spanning from 1950 – 2001. The estimates from the findings of Verma and Wilson do not support the commonly accepted Solow and endogenous models of economic growth.

Nwanchukwu and Festus (2007) over viewed the determinants of private savings in Nigeria using vector error correction model. It examined the articles of determinants of private savings in Nigeria. It compared the estimation result of the error-correction model with those of three conventional models Partial-Adjustment, Growth Rate and Static Models. The conclusion is that the ECM performs much better than the other models.

Ogun and Obenbe (2006) examined a long run determinants of saving and investment in Nigeria. A stock and Watson dynamic OLS approach (1979-2004) investigated the long run determinants of aggregate saving and investment in Nigeria in the light of the role of these variables in capital accumulation and growth process.

Ogunleye and Olorunfemi (2006) investigated the impact of Public expenditure on the economic growth in Nigeria: Using the co-integration technique of establishing long run relationships among time series data, recurrent and capital expenditures by the Federal Governments of Nigeria were regressed on the gross domestic product. The evidence suggests that, on the aggregate there is a long run positive relationship between GDP and the total government expenditure.

Olufemi (2008) researched into investment and economic growth in Nigeria using an autoregressive model, he looked at the direction and strength of the relationship between public investment and economic growth in Nigeria, using time series data from 1975 to 2004. The study examined the unit root problem and cointegrating properties of the data. The unit root problem was tested by using Augmented Dickey Fuller (ADF) and Phillip Perron tests. Then the effects of stochastic shocks of each of the endogenous variables were explored using Vector Autoregressive (VAR) model.

III. Methodology

3.1 Model Specification

According to Solow (1956), Growth is determined by rate of savings, investment in physical capital, labour, and population growth. With reference to Solow growth model, the model of this study is hereby specified as follows:

GDP =f (K,SAV)…………………………………………………..(1)

Where GDP = proxy for economic growth,

K = investment. (Proxy for Gross capital formation).

GDP =α_0 + α_1GCF+ α_2SAV+ μ_1…………………………………..(2)

- SAV is National Savings

Again the life cycle hypothesis under the theoretical framework expressed savings as a function of non human wealth (w_t) income (output) y_t, interest rate (r_t) etc i.e. s_t = f(W_t , Y_t , r_t…) the second model for this research work adopted the life cycle hypothesis by Ando Modigliana (1954) and express savings function thus, SAV =f(GDP,GCF)

The third model to be used in this model takes its root also from accelerator principle & neoclassical theory of investment which expresses change in investment as a function of change in output i.e . I = K Y_t.

Where $\triangle$= change in investment, K is capital output ratio, Y_t = change in output.

However the traditional theory of investment favours investment being expressed as a function of interest rate but according to Mackinon (1973) higher interest rate would stimulate rise in saving, increase the volume of domestic credit extended by the financial system and hence affecting equilibrium level of investment. With this assertion, apart from interest rate and change in output expressed by Keynes and classical economist as determinants of investment Mackinoin (1973) has expressed the influence of saving on investment, and consequently our model expressing GCF = f (GDP, SAV) is formulated.

Where GCF is a proxy for investment, GDP (output) is a proxy for growth and savings represent national savings.

The model is explicitly written as:

$GCF = \alpha_0 + \alpha_1\,GDP + \alpha_2\,SAV$…….. (3)

The three models that enabled us study the relationship among Savings, Gross Capital Formation and Economic Growth in Nigeria using VAR are thus formulated:

$GDP_t = f\,(SAV_t\,GCF_t)$……………………………………………(4)

$GDP_t = \alpha_0 + \alpha_1 SAV_t + \alpha_2 GCF_t + \mu_1$…………………………………………..(5)

$SAV_t = f\,(GDP_t\,GCF_t)$…..

$SAV_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 GCF_t + \mu_1$… ………………………………………..(6)

$GCF_t = f\,(GDP_t\,SAV_t)$

$GCF_t = \alpha_0 + \alpha_1 SAV_t + \alpha_2 GDP_t + \mu_1$ …………………………………….(7)

Where ; $GDP_t =$ Gross Domestic Product (Proxy for economic growth)

$SAV_t =$ Gross Savings in Nigeria

$GCF_t =$ Gross Capital Formation

U_i = Error Term

A Priori Expectation

All the explanatory variables are expected to be positively related.

$$\frac{\partial GDP}{\partial GCF} > 0,\;\frac{\partial SAV}{\partial GDP} > 0,\;\frac{\partial GCF}{\partial GDP} > 0,\;\frac{\partial GCF}{\partial SAV} > 0,\;\frac{GDP}{\partial SAV} > 0,$$

$$\frac{\partial GCF}{\partial GDP} > 0$$

N.B. α_0, α_1, $\alpha_2 > 0$

3.2 Estimating Technique

The first step is to examine whether the time series contained in the equation has a unit root. In the cointegration literature, the more frequently used tests for a unit root are the Augmented Dickey-Fuller (1979 and 1981) Philips – Perron (1988) and Perron (1986 and 1988) test. These tests agreed in their treatment to the intercept parameter. Thus, the null hypothesis model to test for unit root has the following form:

$X_t = \mu + aX_{t-1} + E_t$ ....(8)

And the model under the alternative hypothesis:

The estimating technique adopted for this study is cointegration and error connection model. According to Engle and Granger methodology,

$X_t = \mu + \theta(t - \frac{T}{2}) + aX_{t-1} + E_t$ ....(9)

When X_t is the of the time series, and under the null hypothesis; $a = 1$ and $\theta = 0$. T represents the number of observations. In this paper, we use the Augmented Dickey-Fuller (ADF) to test for the stationarity of the time series. The ADF test can be obtained by applying OLS to estimate the coefficients of the following relation:

$$\Delta X_t = \mu + \theta_t + X_{t-1} + \sum_{1}^{n} \lambda_i \Delta X_{t-1} + u_i \qquad …..(10)$$

n is chosen to eliminate the autocorrelation. If a unit root exists, then $y = a - 1$ would not be statistically different from zero. The ADF test can be conducted by comparing the t-value on the coefficient of X_{t-1} with critical values.

The Granger representation indicates that if X_t and λ_t are integrated; they will have an error correlation representation as follow:

$a(L)\Delta\gamma_i = a_0 - \lambda(y_t - a_i X_t) + b(L)\Delta\lambda_t + c(L)E_t$ …................................(11)

Where $a(L)$, $b(L)$ and $c(L)$ are stable and inveritible polynomials, respectively. Such models provide a more attractive way of presenting and modeling cointegrating series. The error correction models combine the long run $(y_t - aX_t)$ and the short run dynamics.

The second step of Engle and Granger methodology consist to estimate the following regression:

$\Delta y_t = a + \sum a^\tau \Delta y_{t-1}^\tau \sum \beta_j \Delta X_{t-1} + bEC_{t-1}$ $\cdots$..(12)

Where A denotes the first difference and the EC represents the error term. The estimated error term coefficient must have statistically significant negative sign. This coefficient indicates the percentage of the disequilibrium in the dependent variable that would be adjusted from period to another. It is widely recognizable that Engle and Granger test for cointegration would be enough if we want to examine the effect of error correction mechanism on the dependent variable for two sequences periods such as t and t – 1.

The maximum Likelihood procedure (Johansen's test), suggested by Johansen (1988 and 1991) is particularly preferable when the number of variables in the study exceeds two variables due to the possibility of existence of multiple cointegrating vectors. The advantage of Johansen's test is not only limited to multivariate case, but it is also preferable than Engle-Granger approach even with a two-variable-model (Gonzalo, 1990).

To determine the number of cointegrating vectors, (Johansen, 1988 and 1991) and Johansen and Juselius (1990) suggested two statistic tests. The first one is the trace test (λ_{trace}). It tests the null hypothesis, that the number of distinct cointegrating vectors is less than or equal to (q) against a general unrestricted alternative (q = r). The second statistical test is the maximal eigenvalue test (λ_{max}). This test concerns a test of the null hypothesis that there is (r) of cointegrating vectors against the alternative that there is (r + 1) cointegrating vectors.

3.3 Sources of Data
Given the nature of the research work, secondary data needed to carry out the empirical analysis on both investment, saving and output (GDP) in Nigeria.Data on savings, GDP and Gross Capital Formation sourced from CBN (2009), Statistical bulletin\.

IV. Results and Discussion.

4.1 Stationarity Test
The summary result of this study includes the Augmented Dickey Fuller test for unit root test to determine the time series characteristics of each variable, co integration regression and the Vector Error Correction Modeling (VECM). In addition the result of the VAR causality test is also presented in this study and their policy implications.

Table 1.Augmented Dickey Fuller tests for Stationary with Intercept and Linear Trend
Unit Root Test Result

Variable	ADF Statistics	Order of Integration
GDP	-6.9579	1 (2) **
GCF	-4.9323	1 (1) *
GNS	-5.0541	1 (2) **

Source: Computed from data
ADF critical value at 5% is -3.5671; ** Stationary after the second difference
* Stationary after the first difference

The test in table.1 was conducted with the assumption of constant and trend in the series. . The result in table 1 therefore indicates that all variables are non – stationery at the levels. This is so, as their ADF statistics are all less negative than the critical values at the 5% level of significance. However, the economic implication of non – stationary series is that of prolonged or sustained shock if there is any disturbance to the variable. Thus Gross Domestic Product (GDP), Gross Capital Formation (GCP) and Gross National Saving (GNS) all exhibit persistence shock.

A further test for unit root to ascertain whether such shock is that of infinity or will die out over time is conducted using the first difference and second difference of each variable as the case may be. The result, also in table 4.1 shows that GDP and GNS are integrated of order two i.e. denoted as 1 (2) while GCF is stationary at the first difference and therefore integrated of order one denoted as 1 (1).The result of the Johansen Maximum likelihood co-integration test and the associated error correction model are presented.

4.2 Cointegration Rank Test for Gross Domestic Product, Capital Formation and Savings
The test is conducted using the Johansen co-integration technique since the model is multivariate. The result of the multivariate co-integration is presented in table 2.

Table 2: Johansen Multivariate Cointegrated Rank Test

Max				Trace			
H_0	H_1	Stat	95%	H_0	H_1	Stat	95%
R = 0	r = 1	44.5477*	24.3500*	r = 0	r = 1	59.8034*	39.3300*
R ≤ 1	r = 2	12.5659	18.3300	R ≤ 1	r = 2	15.2558	23.8300
R ≤ 2	r = 3	2.6699	11.5400	r ≤ 2	r = 3	2.6699	11.5400

Source: Computed from data

* Asterisk(*) indicates statistical significance at the 95% level.

The LR test of Johansen is based on both trace statistics and maximal engel value. The null hypothesis of no cointegration is rejected at r = 0, since at this level, the trace test and maximal engel values are greater than their respective critical values at 5% level of significance. Thus the test indicates 1 cointegrating equation. The evidence of cointegration indicates that in Nigeria there exist a long run relationship among the variables.

4.2.1 Cointegration Regression for GDP

From the methodology, it is clear that there are three equations to be estimated. The first is for the GDP, the second is for GCF and the third is for the GNS. The cointegrating equation normalized to Gross Domestic Product is shown in equation 13.

$$GDP = -8988.01 + 20.9447GCF + 7.4026GNS .. \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.(13)$$
$$(23886) * \quad (014.3804)* \quad\quad (1.1909)* R^2 = 0.82 \quad F (2,31) 31,2606 (0.000)$$

D.W = 2.00: From the equation, it is clear that in the long-run, gross capital formation and gross national saving impact positively on gross domestic product. The result further shows that the impact of gross capital formation is not statistically significant but that of gross national saving is significant at 5% level. The result is in line with the apriori expectation. Again, the value of the R square is 0.82. This means that systemic variations in the GDP is explained to the tune of about 82% by both gross capital formation and gross national saving. Expectedly, the F statistics value which is used to test the overall significance of the entire model indicates that the model is statistically significant at 5% significant level. The Durbin Watson value of 2.0 is an indication that the model is not having the problem of auto-correlation.

4.2.2 Co-integration Regression for GCF

The co-integrating equation normalized to Gross Capital Formation is shown in equation 14.

$$GCF = 9227 + 0.00306GDP + 0.0381GNS. . (14)$$
$$(23087) * (0.00204)* \quad (0.020451)*$$
$$R^2 = 0.64 \quad\quad\quad\quad\quad\quad\quad F (2,31) 27.4486 (0.000)$$
$$D.W = 1.7$$

The regression equation 14 shows that Gross Capital Formation is positively related to both gross domestic product and gross national saving. It is also revealed from the result that both savings and gross domestic product does not have significant impact on the gross capital formation individually. However the whole model passed the overall test of statistical significance. This follows the F test carried out which show that the F- statistics is significant at 5% hence, it can be concluded that both gross domestic product and savings will jointly have a significant impact on the gross capital formation in the long run. The R square which measures the variation in capital formation that is explained by both gross domestic product and savings is relatively high i.e. about 64% variation in capital formation is explained by both gross domestic product and savings. Finally, the Durbin Watson value of 1.7 is an indication of absence of autocorrelation problem.

4.2.3 Cointegration Regression for GNS

The cointegrating equation normalized to Gross Capital Formation is shown in equation 15.

$$GNS = -15907 + 0.0749GDP + 2.6435GCF. . (15)$$
$$(238992) * (0.01258)* \quad (1.4184)*$$
$$R^2 = 0.82 \quad F (2,31) 71.8033 (0.000)$$
$$D.W = 1.8$$

Just like the two previous equations the empirical result as shown in equation 3 conforms to the apriori expectation, there is a positive relationship between savings and the two explanatory variables i.e. gross domestic product and capital formation. However it should be noted that the result further shows that GDP has a significant impact on savings while capital formation does not. Again the F test revealed that the model passed over all test of statistical significance therefore, the joint inclusion of GDP and GCF in the model with impact significantly on savings (GNS). The Durbin Watson value of 1.8 means no autocorrelation problem.

4.3 Vector Error Correction Mechanism

Table3: The VEC Model for DGDP

Regressor	Coefficient	Standard error	T-ratio	Probability
Constant	-95580.8	344776.0	-0.27723	0.789
Trend	-37158.3	47175.8	-0.78766	0.454
Ecm1(-1)	7897954	442046.0	17.8668	0.000

R-Squared   0.99979
F-stat   F(19.8) 2032.9 (0.000)

Table 4: The VEC Model for DGNS

Regressor	Coefficient	Standard error	T-ratio	Probability
Constant	-117703.4	73111.7	-1.6099	0.146
Trend	16973.0	10003.9	1.6966	0.128
Ecm1(-1)	-728177.3	93738.3	-7.7682	0.000

R-Squared   0.99979
F-stat   F(19.8)   152.0980(0.000)

Table 5:The VEC Model for DGCF

Regressor	Coefficient	Standard error	T-ratio	Probability
Constant	-2639.9	5760.2	-0.45830	0.659
Trend	2337.6	788.1660	2.9659	0.018
Ecm1(-1)	-11569.6	7385.3	-1.5666	0.045

R-Squared   0.98634
F-stat   F(19.8) 30.395 (0.000)

The significant positive coefficient of the e_{t-1} indicates that GDP does not responds to disequilibrium from GNS and GCF during the period under review. This is pointer toward the fact that shocks in national saving as well as the gross capital formation in Nigeria might not significantly affect the GDP value during the period under review.

The VEC model of the GNS shows that e_{t-1} is negative and its significant. This means there is a disequilibrium in current value of the GNS and the values of GDP and the GCF can be adjusted in such a way that they will both restore equilibrium.Therefore both GDP and GCF can be adjusted such a way that they will both restore equilibrium in the value of the GNS.

In the third VEC model for the GCF, there is also a significant negative et-1. which is an indication that both GNS and GDP account significantly for disequilibrum in the value of GCF in Nigeria during the period under review. The revelation from the VECM is that Nigeria as an economy is experiencing a weak influence of GNS and GCF on the GDP. In other words the level of influence of GDP on both is more than the influence they both have on the GDP. The findings are in line with findings of some authors like Iyoha 2002 that the GDP of Nigeria is influenced by divers variables apart from some key macroeconomic variables.

However, the three VEC models have high R square and significant F statistics. This attests to the fact that a very strong linkage exist among the three macroeconomic variables in the country during the year under review. The causality test is just a further test of the level of bond among the three variables and this is shown below.

4.4 VAR Causality Test

The granger causality test was carried out to verify the direction of causality among the three variables that is GDP i.e. gross domestic product which is proxy for growth, GCF i.e. gross capital formation and GNS i.e. gross national savings. The result of the causality test is presented in table 6.

Table 6 – Causality Test

Variable	Causality Direction		F Value	Probability
GDP, GCF	GDP	GCF→	23.2675	0.000
GCF, GDP	GCF	GDP→	213.9617	0.000
GDP, GNS	GDP	GNS→	55.8999	0.000
GNS, GDP	GNS	GDP→	100.0728	0.000
GCF, GNS	GCF	GNS→	262.3681	0.000
GCF, GDP	GCF	GDP→	119.1174	0.000

Source: Authors Computation

Table 6 is an indication that there exist very strong cross relationships among all the three macro economic variables in Nigeria. In other words our analysis from the causality test shows that there exist

bidirectional causality between GDP and GNS, also between GNS and GCF and finally between GDP and GCF. Consequently, the implication is that any policy made on any one will definitely have a spiral effect on others.

V.   Conclusions and Recommendations
From the findings, the following conclusions and recommendations are drawn:
1. **Proper Harmonization of Policies**
   This research work has confirmed the existence of strong linkages among growth, savings and capital formation in Nigeria, consequently duplication of policies on the three should be minimized. This is because any policy made on one will in both short and long runs have great influences on the other. This effort will enable the government to prevent wastages of both human and material resources.
2. **Development of the real sector of the economy:**Empirical literature reviewed in this research work have shown that the three variables can only be harmonizes properly when accompanied with increase in production. This condition has been described by Ogun and Obenbe (2006) as a way of boosting the over all growth of the economy.
3. **Acceleration of the Growth of Capital Formation:**The empirical findings from this research work has indicated that the role of savings and GDP in promoting capital formation in Nigeria going by the value of the R square of capital formation equation in the long run of about 64%. It appears to be the lowest out of all the three equations. It simply means that the rate at which the government utilizes GDP and savings for the purpose of investment is not adequate. On this note effort should be made by government to ensure more plough back of the nation's income to increase investment expenditure.
4. **The Grass root Mobilization of savings from the surplus sector to deficit Sector :**The estimation from the findings for growth revealed that there is a positive relationship between growth and capital formation on one hand and a positive relationship between growth and savings on the other hand. When the two variables (savings and capital formation) combine together, they have impact on GDP. It's therefore recommended that strong policy that would encourage savings from the grass root be established.

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