# MACRO ECONOMIC AGGREGATES IN A DEVELOPING ECONOMY: THE NIGERIAN EXPERIENCE 1981 TO 2015

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## Abstract

*The study examines the impact of macro-economic aggregates in a developing economy for 35years (1981 to 2015). We applied vector auto regression and co-integration model of analysis in this study. The macro-economic variables that were considered are inflation and interest rates, money supply and domestic debt while GDP was applied as proxy for a developing economy. The results from ADF indicates that the specification includes a constant which is viewed to be plausible on all the variables. The Johansen cointegration test reveals that the trace and max eigenvalue statistic fails to reject the series of at most 1 cointegrating relationship at conventional level.  Furthermore, the major source of variation in GDP is own shock. Based on the above, the monetary authorities should be proactive on certain key policies on how to improve the economy because every policy taken that will bring about such an improvement is felt through the GDP.*
*Keywords: Inflation rate, interest rate, money supply, domestic debt, GDP, economy. Adjustment.*

## Introduction

At various discussions, economic policies have generated debates which have influenced economic growth in developing economies of the world. Such that when policy makers aggregate issues affecting economic growth several arguments are brought to bear. It is therefore an obvious fact that economic growth has remained the yard stick for determining the level of growth in virtually every nation. Economic growth is therefore seen as the increase in the value of goods and services produced in an economy or the rate of change of real income or real output (Begg, 2003). Economic growth is also used to evaluate both resources and capabilities of a country which could be quantitative and qualitative in nature. Price stability is an important element in every economic system because it affects the smooth functioning of a market system and further conveys information about relative scarcity (Samuelson and Nordhaus, 2005). They further argued that inflation imposes many costs which could be visible

and non-visible. Thus, the rise in the general price level of goods and services leads to inflation. Interest rate is controlled through the banks by the monetary authorities in Nigeria. And as such, interest rates directly affects the credit market because the cost attached could either by very high or low which affects borrowing. Thus, changes in interest rates will bring about some level of stability in the economy.

Domestic debt is viewed as a situation whereby the borrowing units acquires money from itself, implying that you lend to yourself (Herber, 2006). Therefore, such debt are regarded as policy statement of the government regarding its financial implication concerning her financial liabilities. In the views of Herber (2006) he added that debt is merely a means of meeting a particular budgetary situation which could mean budget deficit. And as such, domestic debt is a public sector borrowing requirement for all levels of government.

Macro-economic aggregates applied in this study are interest rate, inflation rate, money supply and Domestic debt while GDP is applied as proxy for the Nigerian economy.

## Theoretical Foundation
### Interest Rates

Interest rates policy has been a critical issue due to its impact on economic growth. This is borne out of the fact that it induces savings which is regarded to be channeled into productive investments leading to increase in employment and output. Thus, interest rates policy is viewed as a major tool engaged by monetary authorities to regulate the value, supply and the cost of money in an economy. In other words, the tempo of economic activity in any economy to a larger extent is influenced through interest rates. We can therefore say that the fundamental function of interest rate is in the area of financial intermediation because interest rates serves as incentive to savers because it will induces savers to postpone present consumption for the future. Interest rate is also regarded as a component of cost of fund because it will affect demand, allocation and loanable fund coupled with domestic interest rates. This was further corroborated with the position taken by CBN, (1993) where it argued that the primary role of interest rate is to help in the mobilization of financial resources and to further ensure the effective utilization of such resources in the promotion of economic growth and development. We will therefore conclude that the direction and magnitude of changes in the market for interest rates are of primary concern to economic agents and policy makers.

In the views of Gbosi, (2005) he opined that several factors influence the behaviour of interest rates, prominent among them are real income, savings, investment, price index, expected inflation, government spending and taxation among others. And as such, government policy is determined by the level of interest rate in the economy. Since the role of interest rate cannot be under estimated in any economy, its impact is felt in all sectors of the economy. The common objective of the central bank of Nigeria over interest rate policy is therefore to reduce its burden on domestic debt servicing on the government so as to accelerate economic development.

### Inflation Rates

Inflation is a worldwide phenomenon (Afolabi, 1999). In his views, the worst evil of inflation is that it deprives money of its services as a store of value. He further asserted that

inflation acts like tax because people are forced to spend less than their income and pay the difference to the government in exchange of extra money. Towards this backdrop, inflation is the rate at which the general price level for goods and services is rising which affects the purchasing power of any given currency. Inflation is thus measured in terms of consumer price index.

Since inflation is a social malady, as well as a pervasive economic problem whose effects are felt in all sectors of the economy, inflation could be regarded as one of the major reasons why people invest. Thus, any meaningful attempt to curb it would entail trade off among important macro-economic and social objectives such as increase in employment, economic growth and social safety needs (CBN, 1993).

## Domestic Debt

Domestic debt have led countries experiencing unprecedented financial imbalances of which to a larger extent have affected the volume of both financial and developmental challenges concerning fiscal actions of many countries. But it is important to note that the simplest approach to domestic debt is the public sector borrowing over revenue for all levels of government. In the views of Barro (1989) he asserted that debt at a given point in time is the accumulative excess of past spending over past receipts and as such debt could be considered as a stock variable measured at a point in time. Lerner (1948) opined that domestic debt creates no burden for future generation because such debt are owed to each other and as such when such debt is paid off, it is a mere transfer from one group to another thereby maintaining their consumption level. His analysis was based on the grounds that generations co-exist simultaneously which are known as overlapping generational model. While Gbosi, (2004) asserted that when government actual revenue falls short of projected revenue, government will have to resort to borrowing to finance projects of economic importance based on the fact that government will have to respond to numerous social and infrastructural needs of the society. This was corroborated with the position taken by Gbosi, (2005) where he asserted that domestic debt involves borrowing by the government from the banking sector through various monetary policy instruments. This further implies that most domestic debt are issued at market related interest rates. But it is imperative to mention that at all times the level of government expenditure in any fiscal period is responsible for her level of debt.

## Money Supply

Money supply is taken as the total amount of money in circulation at any given point in time (Gbosi, 2005). The components of money supply are currency, demand deposit, saving and time deposit which are important for monetary authorities (Onoh, 2002). An increase in money supply directly increases aggregate demand. Under condition of full employment, any rise in aggregate demand raises price level, and such an inappropriate increase in money supply can raise or low interest rate and thus, affects macroeconomic stability. Since money refers to the quantity or stock of money available in an economy at any point in time, the size of money and other variables in the economy is that which will be adequate to finance the amount of goods and services available at full employment level without creating inflationary tendencies.

## Economic Growth (Developing Economy)

This is the long term expansion of productive potential in any given economy leading to growth in potential output overtime against this back, economic growth is expressed by an

increase in a country's output which is measured using GDP. Thus GDP is the economic model that reflects the value of a country's output which is determined in total monetary value of goods and services produced over a period of time. In every economy, regardless who owns the factors of production, GDP measures the value of output in such an economy. Such measurements are applied by either value added in production, factor incomes which include profit or final expenditure (Jhinghan, 2010). Thus economic growth is measured using data on GDP. Since economic growth is always attributed to the accumulation of human and physical capital coupled with increase in productivity due to technological innovation, its impact is felt by applying GDP. In this study, GDP is applied as proxy for economic growth.

**Methodology**

In the application of econometrics, the conventional approach is based on the assumption of stationarity of time series data. Time series data to a larger degree has unit root which might lead to spurious results leading to high volatility of results. These are solved by transforming the data into stationarity through differencing of the time series data which will bring about a new order of intergration. Conintegration and Vector autoregression are also applied in this study.

In testing for co-integration, we are looking at the long run relationship between domestic debt, interest and inflation rates and money supply on economic growth. (GDP).

**Model Specification**

The model is specified as

GDP = f(Intr, inflr, Db, Ms)

The function is represented using loglinear econometric formal as

$$LogGDP = q\ fq_1 \log Infr_t + q_2 \log Intr_t + q_3 \log Db + q^4 \log ms + \Sigma$$

Where;

|      |   |                      |
|------|---|----------------------|
| GDP  | = | Gross domestic product |
| Infr | = | Inflation rate       |
| Intr | = | Interest rate        |
| Db   | = | Domestic debt        |
| Ms   | = | Money supply         |
| T    | = | time                 |
| $\Sigma$ | = | Random           |

In checking for order of integration among the variables, augmented Dickey Fuller unit root test was applied. This is because it is good for rejecting and accepting any given hypothesis.

The general formular is given as

$$\Delta yt = do + d^1 y^1 - 1 - \sum_{t=1}^{n} q \Delta y^t + \Sigma^1$$

$$= \Delta yt = do\ (1-1) + \sum_{n-1}^{n} d1y + d_1 + \Sigma_1$$

Where;

| | | |
|---|---|---|
| y | = | dependent variable |
| d | = | the first difference |
| n | = | Optimum number of lags in the dependent Variable |
| t | = | Linear time trend |

Conintegration; we applied cointegration to determine the order of integration. Thus the number of conintegration vectors can be determined by applying two statistic test which are known as trace statistic and maximum engen value test (Johansen, 1988, 1989) Johanson and Jaselius 1990, Gujarati; 2005).

**Var and Granger**

This was conducted to determine if the current and lagged values of the variables affected each other. While VAR was tested to ascertain the joint significance of each of the lagged endogenous variables.

**Research Domain:** The investigation is concerned with the impact of money supply, interest and inflation rates and domestic debt on economy growth in Nigeria.

**Empirical Interpretation**

The data applied in this study consists of yearly time series of GDP, inflation, interest rates, money supply and domestic debt from 1981 to 2015 (35years) the data is sourced from the central bank of Nigeria's statistical bulletin. The data is transformed into logarithms so as to give reliable estimates.
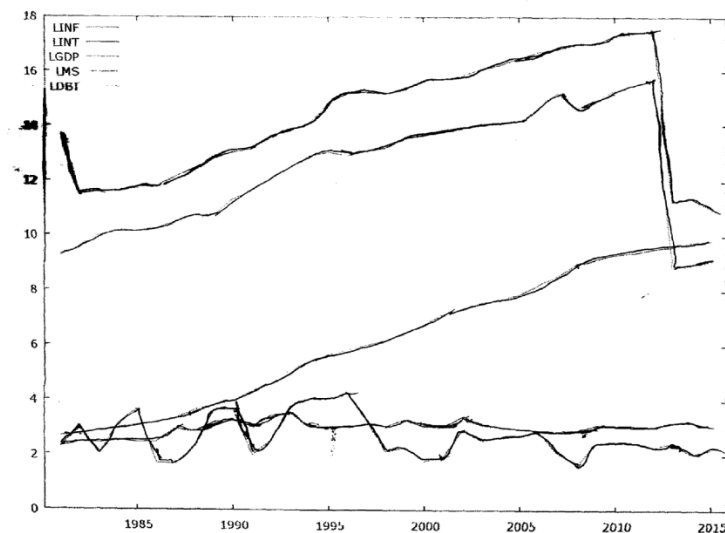


**Source: Eview Version 9**

The figure above indicates that LGDP, LDbt and Lms appears to follow a trending pattern while LINF and Lintr does not follow a trending pattern.

## Unit Root/Stationarity Test

**Table 1**

| | ADF tau-statistic | | | |
| | Level | | First difference | |
| | **Constant** | **Constant & trend** | **Constant** | **Constant & trend** |
|---|---|---|---|---|
| LGDP | -1.2417 (0.6447) | -0.7326 (0.9622) | -5.8927 (0.0000) | 6.3083 (0.0001) |
| LINF | -3.3950 (0.0182) | -3.8244 (0.0277) | -6.3689 (0.0000) | -6.3208 (0.0001) |
| LINT | -2.9424 (0.0510) | -2.7793 (0.2141) | 5.8566 (0.0000) | -6.1053 (0.0001) |
| LMS | -0.7858 (0.8100) | -2.0713 (0.5421) | -3.1564 (0.0320) | -2.4446 (0.3511) |
| LDBT | -1.6585 (0.4426) | 1.7853 (1.0000) | 0.2041 (0.9679) | -0.3392 (0.9851) |

**Table 1: The ADF unit root test (p-values are in brackets)**
**Source: Eview Version 9**

The table above shows the augmented Dickey Fuller (ADF) stationarity/unit root test for LGDP, LINF, LINT, LMS and Dbt data. From the table above, LINF has no unit root and it is integrated of order zero. LDbt is first differenced at conventional level which implies that the series has at least two unit roots. While LGDP, LINT and LMS indicate that the three series are all stationary when differenced once. Thus, the results indicate that the specification includes a constant which is regarded as being the most plausible for all the variables.

## Johnsansen System Contegration Test

| Hypothesized No. of Cointegration | Eigenvalue | Trace statistic | Max eigenvalue statistic |
|---|---|---|---|
| None | 0.5588 | 68.4007 (0.0645) | 25.5426 (0.3493) |
| At most 1 | 0.4560 | 42.8581 (0.1361) | 20.0877 (0.3351) |
| At most 2 | 0.3378 | 22.7704 (0.2575) | 13.5998 (0.3987) |
| At most 3 | 0.1794 | 9.1706 (0.3499) | .5365 (0.5466) |
| At most 4 | 0.07706 | 2.6442 (0.1039) | 2.6442 (0.1039) |

**Table 2: Johansen system cointegration test, p-values in parenthesis**
**Source: Eview Version 9**

The table above shows the report of the Johansen system cointegration test for LGDP, LINF, LMS, LINT and LDbt. From the table there is no evidence of cointegration among the variables as both the trace and max eigenvalue statistic fails to reject the series of at most 1 cointegrating relationship at conventional level.

**Var Lag Length Selection**

| Lag | Log Lik. | LR | FPE | AIC | SIC | HQC |
|-----|----------|-----|-----|-----|-----|-----|
| 0 | -158.0178 | NA | 0.0254 | 10.5173 | 10.7486 | 10.5927 |
| 1 | -19.2702 | 223.7864* | 1.69e-05* | 3.1787 | 4.5664* | 3.6311* |
| 2 | 5.6384 | 32.1402 | 1.95e.05 | 3.1846 | 5.7288 | 4.0140 |
| 3 | 31.0362 | 24.5785 | 2.81e-05 | 3.1590 | 6.8596 | 4.3652 |
| 4 | 65.6356 | 22.3222 | 3.79e-05 | 2.5396* | 7.3967 | 4.1229 |

**Table 3: Lag length selection: *indicates selected lag length**
**Source: Eview Version 9**

From the table above, the VAR lag length order selection is presented. The table clearly shows that LR, FPE, SIC and HQC selected 1 lag for VAR estimation while AIC selected 4 lags which is indicated by the asterisks. This implies that one lag is deemed to be appropriate for the VAR estimation specification.

**Unrestricted Var Estimation**

| Lag | Log Lik. | LR | LINT | LMS | LDBT |
|-----|----------|-----|------|-----|------|
| LGDP (-1) | 0.3809 (0.3889) | 0.1329 (0.5990) | -0.0055 (0.9340) | -0.0192 (0.1165) | 0.2660 (0.5525) |
| LINF (-1) | 0.0384 (0.9001) | 0.3513 (0.0531) | -0.1062 (0.0292)** | -0.0490 (0.0467)** | 0.0037 (0.9907) |
| LINT (-1) | 0.6081 (0.4937) | 0.6532 (0.2051) | 0.7473 (5.58e-06)**** | 0.2233 (0.0028)*** | 0.8214 (0.8214) |
| LMS (-1) | -0.0602 (0.6659) | -0.1261 (0.1225) | -0.0122 (0.5671) | 0.9696 (4.47e-036)*** | -0.1461 (0.3241) |
| LDBT (-1) | 0.5282 (0.2164) | -0.0951 (0.6946) | 0.0168 (0.7945) | 0.0407 (0.2210) | 0.6331 (0.1618) |
| Constant | 0.7075 (0.8130) | -0.1781 (0.9174) | 1.0118 (0.0333)** | -0.3733 (0.1165) | -0.9837 (0.7553) |

**Table 4: The estimated unrestricted VAR results with p-values in parenthesis**

**Source: Eview Version 9**

The table above, shows the result of the LGDP, LINF, LINT, LMS and LDbt data series. As it was stated earlier in table 3, there is no cointegrating relationship among the variables in the VAR system. Our focus therefore is on LGDP equation since we are concerned with the dynamics in GDP. It does appear that none of the variables including own effect has significant effect on GDP which is indicated by their respective P-values.

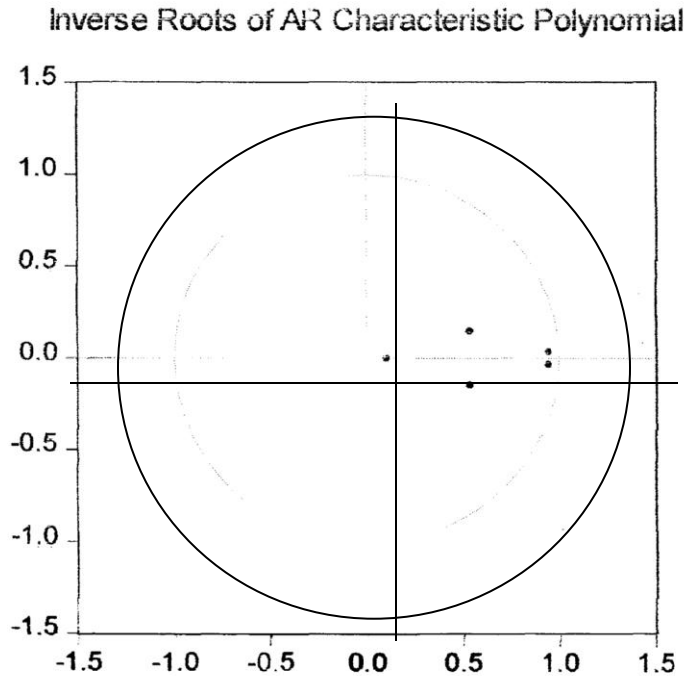## Inverted Ar Root Characteristic Polynomial



Figure 2: VAR inverse roots in relation to unit circle

**Source: Eview Version 9**

The fig. above, shows the plot of VAR inverse roots in relation to the unit circle which is used to examine the stability of the VAR model. As the figure shows, no VAR root is lying outside the unit circle and as such our VAR model satisfies the stability condition.

## GRANGER CAUSALITY/BLOCK SIGNIFICANT TEST

| Dependent variable LGDP | | Dependent variable LINF | | Dependent variable LINT | | Dependent Variable (LMS) | | Dependent Variable LDBT | |
|---|---|---|---|---|---|---|---|---|---|
| Excluded | $X^2$ | Excluded | $X^2$ | Excluded | $X^2$ | Excluded | $X^2$ | Excluded | $X^2$ |
| LINF | 0.0161 (0.8992) | LGDP | 0.2829 (0.5948) | LGDP | 0.0070 (0.9334) | LGDP | 0.3200 (0.5716) | LGDP | 0.3616 (0.5476) |
| LINT | 0.4810 (0.4880) | LINT | 1.6834 (0.1945) | LINT | 5.2849 (0.0215) | LINT | 4.3306 (0.0374) | LINT | 0.0001 (0.9907) |
| LMS | 0.1904 (0.6625) | LMS | 2.5355 (0.1113) | LMS | 0.3354 (0.5625) | LMS | 10.7137 (0.0011) | LMS | 0.7887 (0.3745) |
| LDBT | 1.5991 (0.2060 | LDBT | 0.1574 (0.6916) | LDBT | 0.0691 (0.7926) | LDBT | 1.5671 (0.2106) | LDBT | 1.0073 (0.3155) |
| All | 3.3984 (0.4935 | All | 3.0892 (0.5430) | All | 5.6454 (0.2272) | All | 20.6298 (0.0004) | All | 1.4497 (0.8355) |

**Source: Eview Version 9**

The table above shows the result of the VAR granger causality test. From the table there is an indication that all the variables are not individually and jointly significant in the LGDP

equation. Furthermore, LGDP is not significant in each of the other equation. This implies that LGDP does not granger cause any of LINF, Lint, Lms and LDbt. Lint, Linf, Lms, LDbt does not granger cause LGDP.

Based on these, none of the variables can be treated as exogenous in the GDP equation and GDP cannot be treated as exogenous in the other equation in the VAR system.
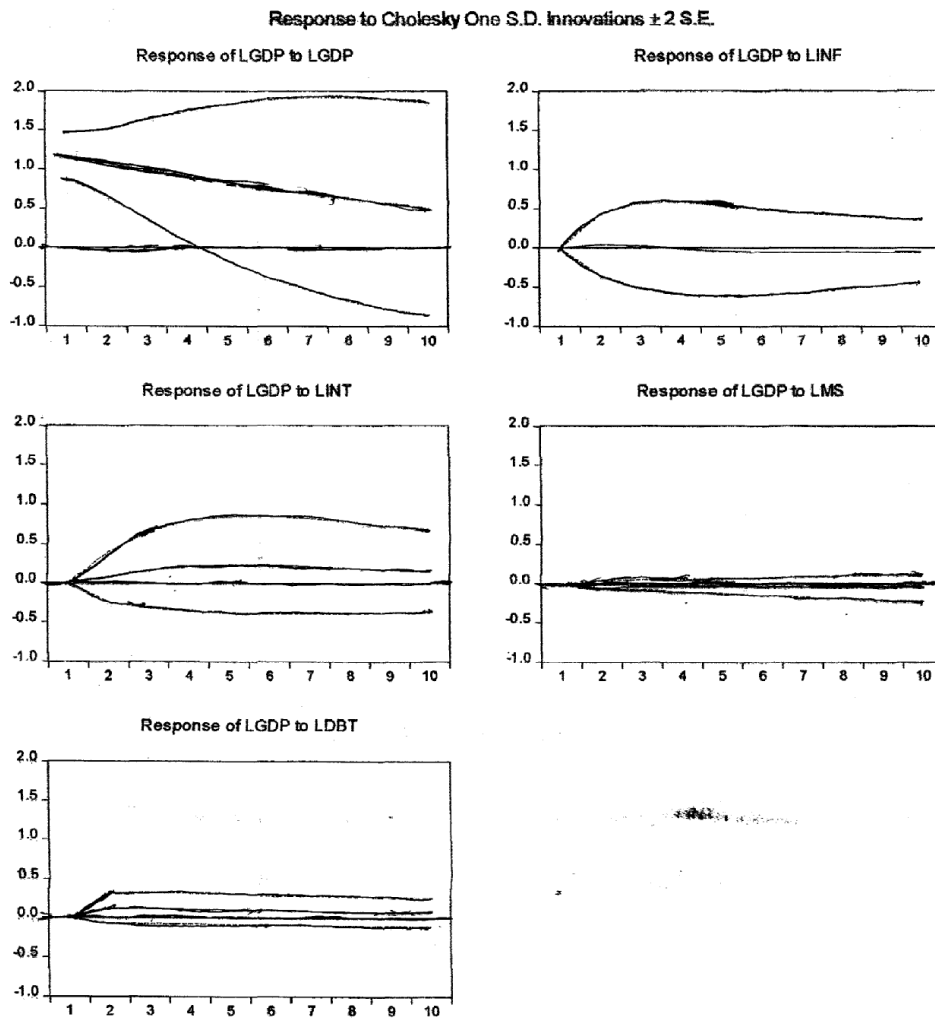
**Impulse Response Function**



**Figure 3: The impulse responses of LGDP**

**Source: Eview Version 9**

The figure above shows the impulse response of LGDP to own shock and shocks to LinF, Lint, Lms and LDbts. Based on the figure, GDP responds positively to its own shock and its effect continued even after the tenth period. Furthermore, shock to inflation has no impact on GDP in the first period while in the second and third periods, the shock appears to have positive impact

and later remained negative for the rest of the period. But shocks to both interest rate and domestic debt have positive impact on GDP throughout the response period. Adjustment in money supply presented negative impact throughout the response period.

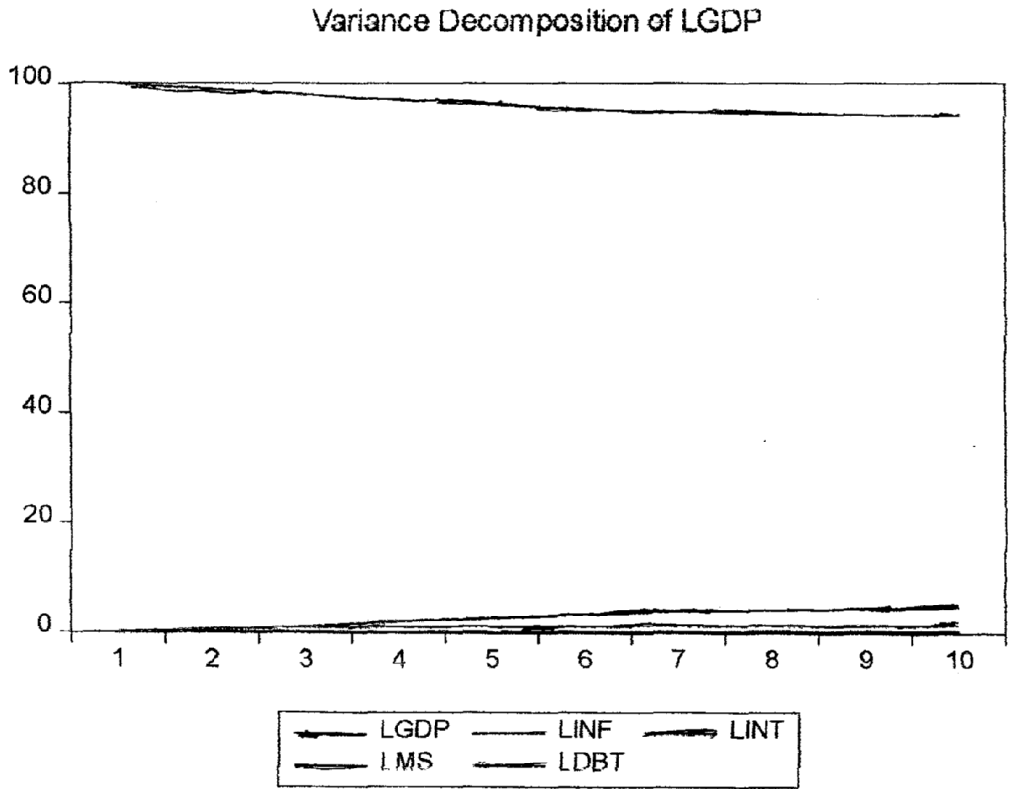## Forecast Error Variance Decomposition (FEVD)



**Figure 4: Forecast variance decomposition of LGDP**

## Source: Eview Version 9

The figure above shows the forecast error variance decomposition for LGDP equation in the estimated VAR for 10 periods. From the figure, the major source of variation in LGDP is own shock which contributed all the variations in LGDP in the first period. More than 95% in the first period and about 94% in the tenth period.

## Conclusion and Findings

This paper examined the impact of macro-economic aggregates in a developing economy for a period of 35years (1981 to 2015), using cointegration and vector autoregression.

The macro economic variables applied in this study are inflation rate, interest rate, money supply and domestic debt while GDP was applied as proxy for a developing economy. The ADF indicates that the variables have at least two unit roots and as such the results imply that there is a constant which is viewed as being plausible. There is also no evidence of cointegration among the variables. The VAR length selection criteria implies that one lag is

deemed be appropriate for the VAR estimation. Furthermore, the VAR model satisfies the stability condition. Finally, GDP responds positively to its own shock with own shock on inflation did not affect GDP while shocks on interest rate and domestic debt had positive impact on GDP throughout the response period. Adjustment in money supply presented negative impact throughout the response period.

Thus, the following findings are summarized as follows:

The data appears to follow a trending pattern. LGDP, Lint and LMS indicates that they are stationary when differenced once. None of the variables can be treated as an exogenous in the GDP equation. Furthermore, the major shock to GDP is own shock which contributed more than 95% in the first period we, therefore recommend that the monetary authorities should as a matter of urgency be proactive on certain key policies on how to improve the economy which is felt on the GDP at any given period in time.

## References

Afolabi, L. (1999). Monetary Economics. Lagos, Heinemana Educational Books.

Begg, D. Fischerd, S. and Dornbush, R. (2003). Economics 7th Edition. London, Mcgrawhill Companies.

Benigno, P. (2003). "Optimal Monetary Policy in a Currency Area" Journal of International Economics.

CBN's Statistical Bulletin, (2014) Vol. 24, Abuja Nigeria.

Central Bank of Nigeria (1993). "Developments in Interest Rates". Research Department Sciences No. 93/10.

Dickey, D. A. & Fuller, W.A. (1979). "Distribution of the estimators for Autoregressive Time Series with a unit Root" Journal of the American Statistical Association Vol. 74.

Gbosi A.N. (2004). Monetary Economics and the Nigeria Financial System, Ibadan, Olorunnighola Publishers.

Gbosi, A.N. (2005). Fundamentals of Modern Economic Analysis Port Harcourt, Sodek Associates.

Granger, C.W.J. (1969). "Investigating Causal Relations by Econometric models and Cross Spectral Methods". Econometrica Vol. 37.

Gujarati, D.N. (2006). Essentials of Econometrics 3rd Edition. Boston, McGrawhill Publishers.

Herber, B.P. (2006). Modern Public Finance 5th Edition. New Delhi, A.I.T. B.S Publishers.

Jhingan, M.L. (2010). Macro-Economic Theory: 12th Ed. India, Vrinda Publication (P) Ltd.

Johansen, S. (1991). "Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models" Econometrica Vol. 59.

Johansen, S. & Juselius, K. (1990). "Maximum Likelihooed Estimation and Inference on cointegration with application to the demand for Money" Oxford Bulletin of Economics and Statistics Vol. 52.

Lerner, A.P. (1948). "The Burden of the National Debt in Income, Employment and Public Policy" Essay in Honour of Alvin Hengen ED

Philips, R.C.B and Peron, P. (1988). "Testing for unit roof in Time series regression" Biometrika Vol. 75.

Samuelson, P.A. & Nordhaus, W.D. (2005). Macro Economics, USA, Mcgrawhill Irvin Publishers.