INFLATION AND NIGERIAN ECONOMIC GROWTH NEXUS:A THRESHOLED ANALYSIS

I.G. Okafor[1], Ugwuegbe, S. Ugochukwu[2], and Ezeaku Hillary C[3]
[1-3]Department of Banking and Finance, Caritas University, Enugu, Nigeria.
ugosbross@gmail.com

ABSTRACT: This study investigated the relationship between inflation rate and economic growth in Nigeria with a view to determining the threshold level of inflation. The study covered the period of 1986 to 2015 and annual data were generated from Central Bank of Nigerian statistical bulletin for the number of years under study. The study adopted Toda-Yamamoto test of causality in determining the direction of causation between the inflation and economic growth as well as other variables included in the model as control variables (money supply, trade openness, and government expenditure).to determine the threshold level we adopted the threshold model developed by Senhadji & Khan, (2001). The result of the empirical analysis reveals that there is a unidirectional causality between inflation and economic growth with causation running from inflation to economic growth. The result of the threshold analysis shows that the optimal level of inflation that will sustain the growth of the Nigerian economy is 11 per cent. We strongly suggest that both the monetary and the fiscal authorities should adopt contractionary monetary and fiscal policy whenever inflation is above the 11% threshold level and engage the revers if the rate of inflation is below the optimal level.

Key words: Inflation, Economic Growth, Toda-Yamamoto, Threshold effect

1.0 INTRODUCTION

One of the central objectives of the monetary authorities is to achieve price stability and economic growth. And to achieve price stability, inflation which has been described as a continuous and persistence rise in the general prices of good as service must be effectively controlled and managed. Inflation is a monetary phenomenon that has been termed different things by many writers both theoretically and empirically, without conclusive evidence among them. Different schools of thought have advanced the concept of inflation with mixed opinions as to the effect of inflation on economic growth (Adeniyi, Oyinlola, Omisakin, & Egwaikhide, 2015; Adhikari, 2014; Attari & Javed, 2013). The concept of inflation has gained importance in economic and financial theories due to its effect on other macroeconomic variables. Variations in inflation rate according to many writers have accounted for significant variations in most of the macroeconomic variables, hence the attention of both policy makers and researchers in understanding and manipulation of this monetary phenomenon as a vital tool for economic growth of any nation. The Central Bank of most nations of the world is saddled with the responsibility of managing the money supply in the country, this

responsibility they perform with a view to achieve price stability and stimulate growth by controlling the rate of inflation in the economy.

2.0 LITERATURE REVIEW

2.1 Theoretical framework

The phenomenon of inflation and its effect on real economic variables has been discussed ever since the appearance of classical economic theory and been developed later on as the development of modern economic theories. In this section, there will be a review of different economic theories, and the focus in this case is on the explanations of inflation and its effect on economic growth.

2.1.1 Classical growth theory: Adam Smith who pointed a supply side driven model of growth laid the Classical growth model. He viewed saving as a creator of investment and hence growth. Therefore, he saw income distribution as being one of the most important determinants of how fast (or slow) a nation would grow. He also posited that profits decline – not because of decreasing marginal productivity, but rather because the competition of capitalists for workers will bid wages up. The link between the change in price levels (inflation) and its effects on profit levels and output were not specifically articulated in classical growth theories. However, the relationship between the two variables is implicitly suggested to be negative, as the reduction in firms' profit levels through higher wage costs. Put simply, according to classical explanation inflation affects economic growth negatively (Gokal and Hanif, 2004).

2.1.2 Keynesian growth theory: In the framework of Keynesianism, the aggregate demand (AD) and aggregate supply (AS) curves are adopted to show the relationship between output and inflation. According to Keynesian, in the short run, the AS curve is upward sloping rather than vertical. If the AS curve is vertical, changes on the demand side of the economy affect only prices. However, if it is upward sloping, changes in AD affect both price and output. This holds with the fact that many factors, such as expectations, prices of other factors of production, fiscal and monetary policy, drive the inflation rate and the level of output in the short-run. When the general prices increase Producers of a certain product feel that only the prices of their products have increased while the other producers are operating at the same price level. However, in reality overall prices have risen. Thus, the producer continues to produce more and output continues to rise. It reveals that according to Keynesian there exists a positive effect of price

increase on output at least in the short-run (Snow don, 2005).

2.1.3 Monetarist growth theory: Monetarists linked inflation and economic growth by simply using the quantity theory of money, by equating the total amount of spending to the total amount of money in the economy. This can be shown as below by taking Velocity of money constant in the short run:

$$\frac{\Delta Y}{Y} = \frac{\Delta M}{M} - \frac{\Delta P}{P}$$

Where: $\frac{\Delta Y}{Y}$=the growth rate of output,

$\frac{\Delta M}{M}$=the growth rateof money supply and

$\frac{\Delta P}{P}$= inflation. The above equation indicates unambiguously negative relationship between inflation and economic growth (Dornbusch and Fischer, 2001).

2.1.4 Neo-classical and endogenous growth theories: Mundell (1963) and Tobin (1965) have explained the effect of inflation on economic growth based on neo-classical growth theory. They depict a positive relationship between inflation and economic growth by assuming that real money balance and investment are substitute. Thus when inflation is high, it will decrease the return on real money balances but the return on investment will increase and people substitute real money balance by investing on other assets. This increases capital accumulation and the economic growth and it will show positive relationship between inflation and economic growth. Contrary to the conclusion of the Mundell-Tobin effect, Stockman (1981) develops a long-run equilibrium growth model with assumption of "cash-in-advance constraint. In the model of Stockman (1981), the two variables relationship is complement, accounting for a negative relationship between the steady-state level of output and the inflation rate. Stockman models this cash investment as a cash-in-advance restriction on both consumption and capital purchases. Since inflation erodes the purchasing power of money balances, people reduce their purchases of both cash goods and capital when the inflation rate rises. Correspondingly, the steady-state level of output falls in response to an increase in the inflation rate. Also return to labor falls when the inflation rate rises. As such, people substitute away from consumption to leisure, because the return on labor falls and this in turn reduce economic growth. Thus, this study has used the combination of the above theory so as to develop the theoretical framework that helps to examine the effect of inflation on economic growth. According to the endogenous growth model, which is the

extended form of the neo-classical growth model, production function is given as:Y = F(K,L,H)

Where,Y,K, L&H are levels of output, physical capital,

labour force and human capital respectively and these variables are known as supply-driven inputs (Dornbusch andFischer, 2001,Romer,1996). Monetarists' link inflation with economic growth using the quantity theory of money as can beseen from equation (1) above. Economic growth in addition tosupply driven factors depends on demand side variables.

2.1.2 EMPIRICAL FRAMEWORK

Adhikari, (2014) looked at the extent to which inflation hampers economic growth in Nepal employing a Distributive Lag Model econometric tool. In this study, economic growth was proxied by logarithm of real GDP at its first difference, while inflation rate was proxied by the logarithm of CPI also at its first difference. The result of the study revealed that the economic growth of Nepal is adversely affected by inflation during the period under study. Ayyoub, Chaudhry, & Farooq, (2011) examined the impact of inflation on the growth of the Pakistan economy employing an annual data for a period of 1973 to 2010 with the help of OLS method of estimation discovered that there is a negative and significant relationship between inflation and economic growth in Pakistan for the period under review.

Attari & Javed, (2013) investigated the relationship between Inflation, Economic growth and Government expenditure in Pakistan adopting a time series data for a period of 1980 to 2010. Their study employed ARDL model, Johansen Co-integration and Granger causality test to investigate the relationship between the variables under study. The result of the econometric analysis shows that there is a long run relationship between rate of inflation, economic growth and government expenditure. The result also revealed that in the short run inflation rate does not affect economic growth but government expenditure affect economic growth in the short run. The result of the granger causality test indicates that there is a unidirectional causality between the rate of inflation and economic growth as well as economic growth and government expenditure.

Bawa & Abdullahi, (2010) in their study examined the threshold effect of inflation on economic growth in Nigerian employing quarterly time series data for a period of 1981 to 2009. They adopted the threshold regression model developed by Khan and Senhadji

(2001), the result revealed that a threshold of 13 per cent is appropriate for the Nigerian economy to remain on the part of growth. Below this threshold according to them inflation will have a mild effect on economic activities while above this level it will wield high negative effect on the growth of the Nigerian economy for the period under review. They also noted that inflation has a negative and significant effect on economic growth at both below and above the threshold level of 13 per cent.

Danladi, (2013) investigated the inflation threshold effect on sustainable output performance in the West African sub-region for the period of 1980 to 2009. The result strongly suggests the existence of a threshold level of 9 per cent beyond which inflation exerts a negative effect on economic growth for the period under study. This findings is contrary to the finding of Bawa & Abdullahi, (2010) who found a threshold level of 13% for Nigeria. The variation in these two results could be attributed to the multiple countries included by the forma.

De Gregorio, (1992) investigated the possibility of nonlinear effect of inflation on economic growth. The result finds evidence of a significant structural break in the function that links growth to inflation. The result suggested a threshold of 8%, below which inflation will not exert any effect on economic growth, above this threshold the effect of inflation on economic growth is said to be robust and extremely powerful in explaining the relationship between the variables under study.

Doguwa, (2005) examined the effect of inflation on economic growth in Nigeria as well as determing the threshold level of inflation in Nigerian economy. The study adopted the model developed by Sarel (1996) and another one developed by Khan and Senhadji (2001), as well as the approach developed by Drukker et al (2005). The result of the study revealed that inflation threshold is 9.9 per cent unsing the Sarel's (1996) approach on the other hand the technique developed by Khan and Senhadji (2001) showed that the inflation threshold is 10.5 per cent in Nigerian for the period under study. The third approach by Drukker et al (2005) points that inflation threshold level in Nigerian for the period under study is 11.2 and 12 per cent. The study strongly suggests that the threshold level of inflation for Nigerian economy above 10.5 to 12 per cent will be inimical to the growth of the Nigerian economy. The study concluded that there is a threshold level of inflation above which level money is not super-natural.

Examining the relationship between inflation and economic growth employing data from both developed and developing economies (Eggoh & Khan, 2014)highlighted two aspect of inflation-growth relationship, first they analyzed the nonlinear relationship and found several threshold level for global samples and for various income-specific sub-samples. Secondly they identified some country based macroeconomic features that influence the nonlinearity. The study concluded that that inflation-growth nonlinearity is sensitive to a country's level of financial development, capital accumulation, trade openness and government expenditures. Moreover, these country-specific characteristics result in some marked differences in this nonlinear relationship.

Investigating the impact of inflation on economic growth of Tanzania (Faraji & Kenani, 2013) opined that inflation has a negative impact on economic growth of Tanzania for the period under study. The study concluded that there is no long-run relationship between the variables under consideration. (Ghazouani, 2012)investigated the threshold effect of inflation on economic growth with evidence from MENA region employing an annual time series data for a period of 1961 t0 2010. The empirical result asserts that a threshold level of 10 per cent appears to be optimal above which inflation will be inimical to economic growth.

Asymmetric behavior of inflation differentials in the euro area: Evidence from a threshold unit root test was examined by Giannellis, (2013) and the result revealed that threshold nonlinearity is confirmed in 10 out of 16 cases examined. The result also found unit root regime-switching behavior only in six out of the 16 cases under investigation. This finding implies that inflation rate differentials were persistent when they were low, but transitory when they were high. This asymmetric behavior can possibly be explained by the different degree of pressure exercised on governments, which is accompanied with different inflation rate differentials.

The relationship between inflation and economic growth in Ethiopia was examined by Girma, (2012)who opined that in the shout-run inflation has a positive but not significant effect on the growth of the economy for the period under study. The result of the granger causality test indicates that causation runs from economic growth to inflation and not the other way round, meaning there is unidirectional causality between the variables under study. The result of the empirical analysis shows that there is a long run relationship between

inflation and economic growth in Ethiopia for the period under investigation.

Hussain & Malik, (2011) investigated the relationship between economic growth and inflation in Pakistan employing ECM econometric technique, the result shows that there is a long run relationship between the variables under investigation and the speed of adjustment to short run equilibrium is high at 45%. Empirically the result indicates a unidirectional causality between the variables under study with causation running from Inflation to economic growth. The result also indicates that the optimum threshold level for Ethiopian economy is 9% above which inflation will be inimical to economic growth.

Ibarra & Trupkin, (2011)examined the relationship between inflation and economic growth employing data from 120 countries comprising of both developed and developing countries in the world. The study adopted Panel Smooth Transmission Regression (PSTR) and found that the estimated threshold of inflation for industrialized countries is 4.1% while that of the non-industrialized countries is 19.1%. The speed of transition is relatively smooth in developed countries, but for developing economies inflation rapidly has negative effects on growth when it is near the threshold. In addition, they found that the inflation threshold falls to 7.9% by selecting a reduced group of developing countries, according to a measure associated with institutional quality. Ibarra & Trupkin, (2015) re-examined the relationship between inflation and economic growth for a period of 1950 to 2015 taking into consideration the effect of institutional differences and also found that the threshold effect of inflation on economic growth is higher in developing countries as against the developed once.

Jha & Dang, (2012)in their study examined the relationship between inflation and economic growth with evidence from 182 countries of the world both developed and developing countries and found that for developing countries, there is significant evidence which suggests that when the rate of inflation exceeds 10 percent inflation variability has a negative effect on economic growth and for developed countries, there is no significant evidence that inflation variability is detrimental to growth.

According to Kanchan Datta, (2011) who also investigated the relationship between inflation and economic growth in Malaysia and found that causation runs from economic growth to inflation in the long run but revealed that in the short run causation runs from inflation to economic growth. Khan & Senhadji, (2001)in a cross country analysis investigated the

relationship between inflation and economic growth with evidence from threshold analysis in 138 countries and found that the inflation threshold for the period under review is 19.16% while that of the industrialized countries were estimated to fall between 2.57% and 12.61%. They noted that in the full sample, if the initial inflation rate is below 19.16%, increases in inflation do not have a statistically significant effect on growth. In contrast, when the initial inflation is above 19.16%, further increases in inflation will decrease long-run growth.

Khan and Senhadji (2001) examined the relationship between high and low inflation with economic growth and suggested that there exist a threshold inflation level for both industrialized and developing countries of the world. In their empirical study which employed panel data for 140 developing and industrialized countries for the period of 1960-98. Their results strongly suggest the existence of a threshold beyond which the inflation exerts a negative effect on economic growth. In particular, the threshold estimates are 1-3 percent and 7-11 percent for industrial and developing countries, respectively.

In a study by Mubarik (2005) who estimated the threshold level of inflation in Pakistan employing annual time series dataset from 1973 to 2000. Based on the result, the researcher opined that 9 percent threshold level of inflation is optimal above which inflation is harmful for economic growth. On the same note, Sargsyan (2005) in his study estimated the threshold level of inflation for Armenian economy with a particular focus on the period of 2000-2008 and strongly suggests that for the Armenian economy targeting a level of inflation higher than current 3% but not exceeding 4.5% threshold level might be beneficial for growth in Armenia.

3.0 METHODOLOGY

This study examined the relationship between inflation rate and economic growth in Nigeria as well as establishing the threshold level of inflation with emphasis on the period of 1986 to 2015. This is a period in which the economy witnessed a pragmatic change in the economic structure of the nation with the introduction of the Structural Adjustment Program. The data for this study will be generated from the Central Bank of Nigeria (CBN) statistical bulletin as well as National Bureau of Statistics (NBS). The variables for this study comprises of Inflation rate which will be proxied by the log of consumer price index, economic growth proxird by GDP, Money supply (M_2) Government Expenditures and Trade Openness (TOPN). The choice of this variables is in line

with the model employed in the work of (Omay & znur Kan, 2010, Nkume & Ngalawa, 2014; Nor, Shariff, & Ibrahim, 2010; Onwe, 2014; Pahlavani & Ezzati, 2011; Pypko, 2009; Quartey, 2010) who examined the threshold effects in the inflation–growth with Evidence from different industrialized and developing economies of the world. In their studies, they employed GDP, Inflation Rate (INFR), Government Expenditure (GOV) and Trade openness and money supply (M_2) as some of the variables in their model.

3.1 CAUSALITY MODEL

The relationship between inflation and economic growth and other variables included in the model will be examined using Toda-Yamamoto test of causality developed by Toda and Yamamoto 2005. The choice of this technique over the conventional Granger causality and Engel causality is due to the advantage that the technique has over Granger and Engel. The Granger causality proposed by Granger (1969) has probable shortcomings of specification bias and spurious regression. Engel and Granger (1987) have defined X and Y as being co-integrated if the linear combination of X and Y is stationary but each variable is not always stationary. Engel and Granger (1987) pointed out that while these two variables are non-stationary and co-integrated, the standard Granger -causal inference will be invalid. On the other hand, the ordinary granger causality test can only be carried out between variables that are integrated of the same order one I(1) in which the variables are not always integrated of the same order one. To mitigate these problems, Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) developed a procedure based on augmented VAR modeling, by introducing a modified Wald test statistic (MWALD). This procedure has been found to be superior to ordinary Granger - causality tests since it does not require pre-testing for the co-integrating properties of the system and thus avoids the potential bias associated with unit roots and co-integration tests as it can be applied regardless of whether a series is I(0), I(1) or I(2), non-co-integrated or co-integrated of an arbitrary order.

Toda-Yamamoto Model Specified in Matrix form.

$$\begin{bmatrix} \dot{GDP_t} \\ INFR_t \\ TOPN_t \\ GOV_t \\ M2_t \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \\ \beta_{40} \\ \beta_{50} \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \boldsymbol{\beta_{11,i}} & \boldsymbol{\beta_{12,i}} & \boldsymbol{\beta_{13,i}} & \boldsymbol{\beta_{14,i}} & \boldsymbol{\beta_{15,i}} \\ \boldsymbol{\beta_{21,i}} & \boldsymbol{\beta_{22,i}} & \boldsymbol{\beta_{23,i}} & \boldsymbol{\beta_{24,i}} & \boldsymbol{\beta_{25,i}} \\ \boldsymbol{\beta_{31,i}} & \boldsymbol{\beta_{32,i}} & \boldsymbol{\beta_{33,i}} & \boldsymbol{\beta_{34,i}} & \boldsymbol{\beta_{35,i}} \\ \boldsymbol{\beta_{41,i}} & \boldsymbol{\beta_{42,i}} & \boldsymbol{\beta_{43,i}} & \boldsymbol{\beta_{44,i}} & \boldsymbol{\beta_{45,i}} \\ \boldsymbol{\beta_{51,i}} & \boldsymbol{\beta_{52,i}} & \boldsymbol{\beta_{53,i}} & \boldsymbol{\beta_{54,i}} & \boldsymbol{\beta_{55,i}} \end{bmatrix} \begin{bmatrix} GDP_{t-1} \\ INFR_{t-1} \\ TOPN_{t-1} \\ GOV_{t-1} \\ M2_{t-1} \end{bmatrix}$$

$$+ \sum_{j=1}^{d_{max}} \begin{bmatrix} \boldsymbol{\beta_{11,k+j}} & \boldsymbol{\beta_{12,k+j}} & \boldsymbol{\beta_{13k+ji}} & \boldsymbol{\beta_{14,k+j}} & \boldsymbol{\beta_{15,k+j}} \\ \boldsymbol{\beta_{21,k+j}} & \boldsymbol{\beta_{22,k+j}} & \boldsymbol{\beta_{23,k+j}} & \boldsymbol{\beta_{24,k+j}} & \boldsymbol{\beta_{25,k+j}} \\ \boldsymbol{\beta_{31,k+j}} & \boldsymbol{\beta_{32,k+j}} & \boldsymbol{\beta_{33,k+j}} & \boldsymbol{\beta_{34,k+j}} & \boldsymbol{\beta_{35,k+j}} \\ \boldsymbol{\beta_{41,k+j}} & \boldsymbol{\beta_{42,k+j}} & \boldsymbol{\beta_{43,k+j}} & \boldsymbol{\beta_{44,k+j}} & \boldsymbol{\beta_{45,k+j}} \\ \boldsymbol{\beta_{51,k+j}} & \boldsymbol{\beta_{52,k+j}} & \boldsymbol{\beta_{53,k+j}} & \boldsymbol{\beta_{54,k+j}} & \boldsymbol{\beta_{55,k+j}} \end{bmatrix} \begin{bmatrix} GDP_{t-k-j} \\ INFR_{t-k-j} \\ TOPN_{t-k-j} \\ GOV_{t-k-j} \\ M2_{t-k-j} \end{bmatrix}$$

$$+ \begin{bmatrix} \boldsymbol{\epsilon_1} \\ \boldsymbol{\epsilon_2} \\ \boldsymbol{\epsilon_3} \\ \boldsymbol{\epsilon_4} \\ \boldsymbol{\epsilon_5} \end{bmatrix} \ldots\ldots (\mathbf{1})$$

Where,
GDP_t = Gross Domestic Product at time t
$INFR_t$ = Inflation Rate at time t
$TOPN_t$ = Trade Openness at time t
GOV_t = Government Expenditures at time t
M2= Money Supply at time t

K = the optimal lag length ranging from i=1,2,3……..
β_{10}, β_{20}, β_{30}, β_{40} and β_{50} are the constant term
$\beta_{11,t}$ $\beta_{12,t}$ $\beta_{13,t}$ $\beta_{14,t,}$ $\beta_{15,t}$ …… $B_{55,t}$are the coefficients of the variables taking into consideration the lag length.

GDP_{t-1} = Gross Domestic Product at time t-1
$INFR_{t-1}$ = Inflation Rate at time t-1
$TOPN_{t-1}$ = Trade Openness at time t-1
GOV_{t-1} = Government Expenditures at time t-1
M2= Money Supply at time t-1
d_{max} = the maximum order of integration. j = 1,2,……

$\beta_{11,k+j}$ $\beta_{12,k+j}$ $\beta_{13,k+j}$ $\beta_{14,k+j}$ $\beta_{15,k+j}$ …… $B_{55,k+j}$ are also the coefficients of the variables taking into consideration the lag length and the maximum order of integration.

GDP_{t-k-j} = Gross Domestic Product at time t-k-j
$INFR_t$ = Inflation Rate at time t-k-j
$TOPN_t$ = Trade Openness at time t-k-j
GOV_t = Government Expenditures at time t-k-j
M2= Money Supply at time t-k-j
ϵ_1, ϵ_2, ϵ_3, ϵ_4 and ϵ_5 are the error terms or the stochastic terms

TEST OF CAUSALITY USING MODIFIED WALD TEST STATISTIC (MWTS)

To test the causality running from GDP to INFR

$$H_0^{GDP_t \Rightarrow INFR_t}: \beta_{21,1} = \beta_{21,2} = \cdots = \beta_{21,K} = 0 \text{……..……..(2)}$$

To test the causality running from GDP to TOPN

$$H_0^{GDP_t \Rightarrow TOPN_t}: \beta_{31,1} = \beta_{31,2} = \cdots = \beta_{31,K} = 0 \text{……..….(3)}$$

To test the causality running from GDP to GOV

$$H_0^{GDP_t \Rightarrow GOV_t}: \beta_{41,1} = \beta_{41,2} = \cdots = \beta_{41,K} = 0 \text{…….(4)}$$

To test the causality running from GDP to M2

$$H_0^{GDP_t \Rightarrow M2_t}: \beta_{51,1} = \beta_{51,2} = \cdots = \beta_{51,K} = 0 \text{…….(5)}$$

To test the causality running from INFR to GDP

$$H_0^{INFR_t \Rightarrow GDP_t}: \beta_{12,1} = \beta_{12,2} = \cdots = \beta_{12,K} = 0 \text{…….(6)}$$

To test the causality running from TOPN to GDP

$$H_0^{TOPN_t \Rightarrow GDP_t}: \beta_{13,1} = \beta_{13,2} = \cdots = \beta_{13,K} = 0 \text{…….(7)}$$

To test the causality running from GOV to GDP

$$H_0^{GOV_t \Rightarrow GDP_t}: \beta_{14,1} = \beta_{14,2} = \cdots = \beta_{14,K} = 0 \text{…….(8)}$$

To test the causality running from M2 to GDP

$$H_0^{M2_t \Rightarrow GDP_t}: \beta_{15,1} = \beta_{15,2} = \cdots = \beta_{15,K} = 0 \text{…….(9)}$$

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To test the causality running jointly from INFR, TOPN GOV and M2 to GDP

$$\boldsymbol{H_0^{INFR_t, TOPN_t, GOV_t \& M2_t \Rightarrow GDP_t}: \beta_{12,1} = \beta_{12,2} = \cdots = \beta_{12,K} = \beta_{13,1} = \beta_{13,2} = \cdots = \beta_{13,K} = \beta_{14,1} = \beta_{14,2} = \cdots = \beta_{14,K}\beta_{15,2} = \cdots = \beta_{15,K} = 0} \text{ ....(10)}$$

3.2 THRESHOLD MODEL

To estimate the threshold level of inflation in the Nigerian economy using a threshold model, the study adopted the model developed by Khan and Sendhadji, (2001) and employed by Sweidan (2004) for Jordanian inflation, Mubarik (2005) and Hussain (2005), Nasir and Nawaz (2010) for Pakistani inflation, Shamim and Mortaza (2005) for Bangladesh economy, Li (2006) for developed and developing countries, Munir and Mansur (2009) for Malaysian inflation, Hasanov (2011) for Azerbaijani Economy.

The model for the threshold level of inflation in Nigeria is here under specified.

$$GDP_t = \delta_0 + \delta_1^* INFR_t + \delta_2^* D_t(INFR_t - k) + \delta_{3i}^* Z_{it} + \varepsilon_t \dots\dots\dots\dots\dots.(11)$$

Where:

GDP_t= Gross domestic product at time t

$INFR_t$= Inflation Rate at time t

D_t = is a dummy variable

K = is a threshold level of inflation

Z_{it}= the vector of sets of control variables included in the model which are: Government Expenditure, Trade Openness and Money supply.

ε_t= is the stochastic error term

$\delta_0, \delta_1, \delta_2, \delta_{3i}$= are the coefficient of the estimates

However the dummy variable is defined as follows:

$$D_t = \begin{cases} 1: INFR_t > k \\ 0: INFR_t \le k \end{cases} \dots\dots\dots\dots\dots\dots\dots\dots\dots..(12)$$

Meanwhile Mubarik (2005),Hasanov (2011) and Frimpong&Oteng-Abayie (2010) opined that the parameter *k* denotes the threshold inflation level with the expectation that the relationship between economic growth and inflation is given by: (i) low inflation: δ_1; (ii) high inflation:$\delta_1 + \delta_2$. High inflation implies that if inflation estimate is significant then both $(\delta_1 + \delta_2)$ would be summed so as to reveal their impact on growth and that would be the threshold level of inflation.

3.2 TECHNIQUES OF DATA ANALYSIS

The procedure for Toda Yamamoto (T-Y) test of causality begins with the test of stationarity using Augmented Dickey-Fuller test to establish the order of integration in the variables under consideration. This is to

determine the maximum order of integration (d_{max}) as T-Y test will consider all the variables irrespective of their order of integration. Having determined the maximum order of integration, the next step in the T-Y test is to state a VAR model at level without any consideration on the order of integration. And so, running the VAR model at level form we then determine the optimum lag length (k) using some of the information criteria such as Akaike Information criterion (AIC), Hannan-Quinn information criterion (HQ), Schwarz Information Criterion (SIC) and Final prediction error (FPE). To ensure that the VAR model is well behaved, we test for VAR residual serial correlation using LM-stat as well as VAR residual normality tests. When the test of stationarity indicates that two or more variables are integrated of the same order, a co-integration test may be conducted, this approach does not change the existing procedure in T-Y test as the test for co-integration is only done for the purpose of cross-checking the result of T-Y test if need be. When there is co-integration among the variables, it is important to note that the result of T-Y test must show evidence of causation between the variables otherwise something is wrong with the specification of VAR model. No matter what the conclusion about co-integration is, it is not going to affect what follows in T-Y test procedures. It just provides a possible cross-check on the validity of the results at the very end of the analysis. Therefore, having estimated the preferred VAR model, the maximum order of integration is added to the optimum lag length in each of the variables in the equation. Finally, to draw valid casual inferences, T-Y test procedure utilizes a modified Wald test statistic (MWTS) restricting the parameters of k^{th} optimal lag order of the vector autoregressive. The MWTS statistic has an asymptotic chi-square distribution when VAR ($k+d_{max}$) is estimated. The MWTS test the hypothesis that the coefficients of (only) the first K lagged values of X are zero in the Y-equation, using a standard Wald test. Then we do the same thing for the coefficients of the lagged values of *Y* in the X-equation so as to determine the direction of causation between X and Y.

However, to evaluate the threshold model we estimated regressions for different values of *k* which is chosen arbitrarily in an ascending order (that is 2, 3,4 and so on), the optimal value of *k* is obtained by finding the value that maximizes the *R-squared* (R2) or minimizes the *Residual Sum of Squares* (RSS) from the respective regressions(Hasanov2011). The lack of knowledge of the optimal number of threshold points and their values complicates

estimation and inference. Though the procedure is widely accepted in the empirical literature, it is tedious since several regressions have to be estimated. Khan and Senhadji (2001) discussed the details of the estimation procedure and the computation methods in their work were we adopted the threshold model.

4.0 DATA ANALYSIS AND INTERPRETATION

The result of the data analysis were here under presented and for easy understanding and clarity we will start with the result of the causality produced by employing Toda Yamamoto test of causality. The result of the Toda-Yamamoto test revealed that there is a unidirectional causality between inflation and money supply, trade openness economic growth in Nigeria with causation running from money supply, and trade openness to inflation while causation runs from inflation to growth. The result also shows a unidirectional causality between inflation and government expenditures with causation running from inflation to government expenditures and not otherwise. It can also be seen from the empirical result that all the variables included in the model when taken together causes the variation in inflation rate in Nigeria foe the period under review. On the other hand the result portrays that all the variables included in the model individually with the exception of inflation does not cause variation in economic growth but it shows that when taken together they all have a causal effect on economic growth in Nigeria for the period under review. Based on this result we conclude that there is a unidirectional causality between two main variables in this study (inflation rate and economic growth in Nigeria) for the period under study. See appendix 1.

The result of the threshold model as shown in appendix 2 reveals that the optimal inflation rate in Nigeria is 11 per cent above which inflation will have a negative infect on the growth of the Nigerian economy. The result showed that using both the TSLM and LM the threshold of 11 per cent minimizes the sum of square residual (RSS) and maximizes the R-square which is the condition precedence for the determination of the optimal threshold level. (see appendix 2). The implication of this result is that the economy of Nigeria will continue to grow significantly if inflation rate is maintained at a level below 11 per cent threshold. This result however corroborated the findings of Khan and Sandhaji (2001) who also found a threshold level of inflation of of 11 per cent for developing countries. This result also revealed a threshold level which is higher than the result of Sergii (2009) who found a

threshold of 8 per cent for transition countries, while the result is lower than the findings of Hasanov, (2011) and Espinoza et al. (2010) who opined that the optimal threshold level of inflation is 13 per cent for oil exporting countries and Azerbaijanin economy. On the other hand the result of Kremer et al. (2009) revealed that the threshold level of inflation is 17 per cent for non-industrialized countries which is also higher than the 11 per cent we found in Nigerian economy.

5.0 CONCLUSION AND POLICY RECOMMENDATIONS

The study investigated the threshold effect of inflation on economic growth as well as the relationship between inflation and economic growth in Nigeria for the period of 1986 to 2015 employing both threshold regression modeldeveloped by Khan and Sendhaji (2001)and Toda-Yamamoto test of causality for the empirical analysis. The study adopted money supply, trade openness and government expenditures as control variables as well as instrumental variables for the two stages least square method. The result of the empirical study reveals that the threshold level of inflation in Nigeria for the period under study is 11% which implies that at any time the rate of inflation in Nigeria is above this threshold, inflation will have a negative impact on the economic growth. Based on this, the monetary and fiscal authorities should adopt contractional economic policies like the sale of money market instrument to the public, increase monetary policy rate and reserve requirement, minimize the volume of money supply in circulation, and increase taxation as well as adoption of budget surplus whenever inflation crosses the threshold level 11%. We also strongly suggest that a revers policy should be adopted when the rate of inflation fall below the optimal level of 11%. The result of the Toda-Yamamoto test reveals that there is a unidirectional causality between inflation rate and economic growth in Nigeria with causation running from inflation togrowth only. This however implies that increase in inflation rate will result to increase in economic growth. Comparing the two results it can be seen that inflation has a positive impact on the growth of the Nigerian economy but will only continue to exert positive effect if the rate of inflation is maintained at 11%. This result corroborated the Keynesian theory on inflation which stipulates that inflation will only hamper the growth of the economy of the economy is operating at full employment level. In other word they are of the opinion that at a given level of inflation the economy will maintain a sustainable growth rate as the profit made by the business units from increase in the price level will be

channeled into productive activities which will in turn generate employment and increase the aggregate output.

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Appendix 1

VAR Block Exogeneity Wald Tests
Date: 03/28/16 Time: 09:41
Sample: 1996 2015
Included observations: 16

Dependent variable: LOG(GDP)

Excluded	Chi-sq	Df	Prob.
INFR	0.888869	2	0.0120
LOG(GOVEX)	1.213796	2	0.5150
LOG(M2)	0.403439	2	0.1373
LOG(TOPN)	0.022870	2	0.1886
All	10.36720	8	0.0402

Dependent variable: INFR

Excluded	Chi-sq	Df	Prob.
LOG(GDP)	17.11722	2	0.2102
LOG(GOVEX)	2.726862	2	0.2558
LOG(M2)	8.150230	2	0.0170
LOG(TOPN)	20.06694	2	0.0000
All	44.21518	8	0.0000

Dependent variable: LOG(GOVEX)

Excluded	Chi-sq	Df	Prob.
LOG(GDP)	6.746402	2	0.0343
INFR	7.451219	2	0.0241
LOG(M2)	15.06911	2	0.0005
LOG(TOPN)	2.237675	2	0.3267
All	24.20565	8	0.0021

Dependent variable: LOG(M2)

Excluded	Chi-sq	df	Prob.
LOG(GDP)	0.489067	2	0.7831
INFR	0.754242	2	0.6858
LOG(GOVEX)	0.262638	2	0.8769
LOG(TOPN)	1.324857	2	0.5156
All	5.390980	8	0.7151

Dependent variable: LOG(TOPN)

Excluded	Chi-sq	df	Prob.
LOG(GDP)	0.783734	2	0.6758
INFR	0.896473	2	0.6388
LOG(GOVEX)	2.823150	2	0.2438
LOG(M2)	5.123580	2	0.0772
All	36.69695	8	0.0000

Source: Eview Result

Appendix 2

Least Squares Estimation of inflation threshold model from K = 2 to K = 19

Dependent variable:LOG(GDP).

Variable	Coefficient	Std. Error	t-Statistic	Prob		
C	-11.74355	30.40177	-0.586768	0.70729	R-squared	0.099748
INF	13.56584	16.67395	0.586131	0.43109	RSS	471.7162
D2*(INF-2)	-13.94385	16.74413	-1.216872	0.44699		
C	-3.385567	12.49528	-0.658666	0.81549	R-squared	0.185871
INF	7.38574	5.49578	1.07893	0.21539	RSS	407.0983
D3*(INF-3)	-7.842952	5.954866	-1.435422	0.24279		
C	-1.367769	8.282055	-0.441804	0.89629	R-squared	0.287506
INF	5.636104	2.764335	1.329091	0.09359	RSS	330.8413
D4*(INF-4)	-6.73219	3.559633	-1.940193	0.11699		
C	1.62588	6.404236	0.049743	0.77759	R-squared	0.32149
INF	4.090316	1.725784	1.666831	0.06399	RSS	305.3433
D5*(INF-5)	-5.404919	2.195315	-2.32498	0.08969		
C	3.61883	5.392658	0.43564	0.50479	R-squared	0.334402
INF	3.232346	1.348913	2.033873	0.05129	RSS	295.6551
D6*(INF-6)	-4.2376	1.67995	-2.278849	0.08079		
C	4.131398	4.411818	0.40337	0.36669	R-squared	0.377595
INF	2.689768	0.949076	2.291792	0.03069	RSS	263.2478
D7*(INF-7)	-3.741215	1.380957	-2.409584	0.05549		
C	4.030734	3.688086	0.653205	0.30439	R-squared	0.494143
INF	2.365725	0.432052	2.813106	0.00399	RSS	175.8014
D8*(INF-8)	-3.951707	1.041889	-3.115346	0.01399		
C	4.582338	3.566681	1.08036	0.23429	R-squared	0.536367
INF	2.276704	0.407196	3.250844	-0.00111	RSS	144.1205
D9*(INF-9)	-4.292558	0.645104	-3.706438	0.00559		
C	4.879603	3.415721	1.193749	0.19299	R-squared	0.546704
INF	2.223962	0.440788	3.428325	-0.00211	RSS	136.3653
D10*(INF-10)	-4.334909	0.772851	-3.676378	0.00389		
C	**4.620061**	**3.071198**	**1.012381**	**0.18219**	**R-squared**	**0.596645**
INF	**2.205188**	**0.391518**	**3.57715**	**-0.00371**	**RSS**	**98.4029**
D11*(INF-11)	**-4.578942**	**1.097493**	**-3.598904**	**0.00109**		
C	4.779751	3.054423	1.191295	0.16429	R-squared	0.584506
INF	1.889872	0.069145	3.448987	-0.00491	RSS	108.0023
D12*(INF-12)	-5.151134	1.176011	-3.775005	-0.00101		
C	5.076272	3.035148	1.395124	0.13799	R-squared	0.595986

INF	1.929416	0.145826	3.667449	-0.00561	RSS	102.3885
D13*(INF-13)	-5.969543	1.078855	-4.101356	-0.00231		
C	5.516795	2.958219	1.547506	0.10509	R-squared	0.593649
INF	2.027782	0.355182	3.877966	-0.00541	RSS	101.1421
D14*(INF-14)	-6.438578	1.356647	-3.969294	-0.00201		
C	6.05022	2.705379	1.490647	0.07159	R-squared	0.566792
INF	1.7671	0.309715	3.594202	-0.00351	RSS	121.2926
D15*(INF-15)	-6.770756	1.688028	-3.640146	0.00109		
C	7.397643	2.964162	1.876208	0.04429	R-squared	0.505008
INF	1.197276	0.065288	2.855514	0.00319	RSS	167.6493
D16*(INF-16)	-6.845928	1.99405	-3.189296	0.01149		
C	8.694087	3.358435	2.313664	0.03059	R-squared	0.439863
INF	1.015484	0.153593	2.4999	0.01559	RSS	216.5278
D17*(INF-17)	-7.345829	2.155284	-3.065088	0.02929		
C	5.766795	3.208219	1.797506	0.1153	R-squared	0.703649
INF	2.217782	0.545182	4.067966	0.0048	RSS	222.3521
D18*(INF-18)	-6.118578	1.676647	-3.649294	0.0082		
C	6.59022	3.245379	2.030647	0.0818	R-squared	0.676792
INF	1.9771	0.519715	3.804202	0.0067	RSS	242.5026
D19*(INF-19)	-6.540756	1.918028	-3.410146	0.0113		

Source: Extract from Eview result

Note: GOVEX, M2, TOPN were used as control variable hence did not reflect in the threshold result presented for the lack of space.

Two-Stage Least Squares Estimation of inflation threshold model from K = 2 to K = 19

Dependent variable:LOG(GDP).

Variable	Coefficient	Std. Error	t-Statistic	Prob		
C	-11.34357	32.73267	-0.547968	0.73669	R-squared	0.07986

INF	13.59238	17.93884	0.530774	0.46539	RSS	465.8962
D2*(INF-2)	-14.00527	18.03063	-1.165363	0.47969		
C	-3.587889	14.5337	-0.641037	0.82959	R-squared	0.16117
INF	7.449642	6.184697	0.946582	0.26639	RSS	406.9742
D3*(INF-3)	-7.906006	6.655723	-1.317128	0.29249		
C	-1.90829	9.78833	-0.477127	0.87009	R-squared	0.2681
INF	5.774867	3.169686	1.162264	0.12939	RSS	329.479
D4*(INF-4)	-6.872174	3.986315	-1.797625	0.15329		
C	1.137273	7.641707	-0.056305	0.85759	R-squared	0.30357
INF	4.191942	1.992695	1.477769	0.09479	RSS	303.778
D5*(INF-5)	-5.508265	2.484584	-2.172363	0.12189		
C	3.19747	6.491517	0.261379	0.61719	R-squared	0.31679
INF	3.305149	1.543497	1.826241	0.08019	RSS	294.1972
D6*(INF-6)	-4.311811	1.896227	-2.121175	0.11159		
C	3.688115	5.395575	0.172334	0.49279	R-squared	0.36205
INF	2.756184	1.098281	2.057237	0.05369	RSS	261.3946
D7*(INF-7)	-3.809653	1.551653	-2.239175	0.08109		
C	3.470683	4.496815	0.361725	0.44849	R-squared	0.48466
INF	2.44147	0.54136	2.526134	0.01519	RSS	172.5382
D8*(INF-8)	-4.031889	1.172041	-2.909479	0.02739		
C	4.026729	4.300237	0.749088	0.37369	R-squared	0.52863
INF	2.346641	0.499092	2.935608	0.00709	RSS	140.6756
D9*(INF-9)	-4.369956	0.76122	-3.483357	0.01559		
C	4.356949	4.123227	0.843937	0.32229	R-squared	0.53898
INF	2.286972	0.525782	3.100287	0.00559	RSS	133.1747
D10*(INF-10)	-4.40956	0.889522	-3.44591	0.01329		
C	**4.0887**	**3.7505**	**0.650899**	**0.31109**	**Rsquared**	**0.59283**
INF	**2.268598**	**0.472184**	**3.237475**	**0.00279**	**RSS**	**89.0637**
D11*(INF-11)	**-4.662391**	**1.220837**	**-3.360026**	**0.00909**		
C	4.256008	3.705593	0.816729	0.28879	R-squared	0.57829
INF	1.951333	0.145205	3.095895	0.00069	RSS	104.6849
D12*(INF-12)	-5.241592	1.307111	-3.526562	0.00589		
C	4.588076	3.663313	1.007526	0.25189	R-squared	0.58973
INF	1.98516	0.217496	3.300001	-0.00051	RSS	98.396
D13*(INF-13)	-6.061775	1.220198	-3.842788	0.00409		
C	5.10678	3.576181	1.150033	0.20079	R-squared	0.58627
INF	2.072588	0.4233	3.499201	0.01021	RSS	98.9015
D14*(INF-14)	-6.521943	1.513142	-3.70323	0.00459		
C	5.772937	3.332174	1.090334	0.14399	R-squared	0.55692
INF	1.795391	0.375171	3.21702	0.00379	RSS	120.173
D15*(INF-15)	-6.829246	1.866444	-3.377829	0.00969		

C	7.30366	3.616023	1.481423	0.09429	R-squared	0.49161
INF	1.205947	0.127715	2.503303	0.01599	RSS	167.5046
D16*(INF-16)	-6.865056	2.198217	-2.951989	0.02529		
C	8.743076	4.031309	1.926186	0.06849	R-squared	0.42402
INF	1.011347	0.212888	2.178361	0.03639	RSS	216.4846
D17*(INF-17)	-7.336076	2.392293	-2.857666	0.04939		
C	7.73366	4.046023	1.911423	0.1045	R-squared	0.60161
INF	1.635947	0.557715	2.933303	0.0262	RSS	288.7146
D18*(INF-18)	-6.615056	2.448217	-2.701989	0.0355		
C	8.933076	4.221309	2.116186	0.0787	R-squared	0.53402
INF	1.331347	0.532888	2.498361	0.0466	RSS	337.6946
D19*(INF-19)	-6.796076	2.932293	-2.317666	0.0596		

Source: Extract from Eview result

Note: GOVEX, M2, TOPN were used as instrumental variable hence did not reflect in the threshold result presented for the lack of space.