INFLATION, INVESTMENT AND ECONOMIC GROWTH IN NIGERIA: WHAT ARE THE THRESHOLD EFFECTS?

Hassan O. Ozekhome

Abstract

This paper empirically examines inflation, investment and economic growth nexus in Nigeria, employing the Neo-Classical Growth Model. Firstly, the impact of the inflation rate on economic growth with the possibility of two threshold levels for Nigeria using annual data from 1980 to 2014 was examined and secondly, non-linearity between inflation and investment is investigated. In particular, the results show evidence of a non-linear relationship with two thresholds (6 percent and 12 percent) between inflation and economic growth. Inflation below the first threshold affects economic growth positively and insignificantly. At moderate rates of inflation, between the two threshold levels, the effect of inflation is found to be negative and significant, and at high rates of inflation, above the second threshold, the marginal impact of additional inflation on economic growth diminishes but is still significantly negative. The results further indicate a non-linear relationship between these two variables with only one threshold at 7 percent. Rate of inflation below the threshold level has positive but insignificant impact, while above the threshold has strong negative and significant impact on investment. Therefore, it is desirable to keep the inflation below 6 percent (first threshold) through sound macroeconomic policies (both monetary and fiscal) because it is at that level it becomes helpful for the achievement of sustainable economic growth and investment.

Keywords: Inflation, Investment, Macroeconomic Stability, Thresholds Effect, Non-linear relationship

JEL Codes: E31, E22, B22, C30, C18

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1.0 INTRODUCTION

Recent developments in the theory of investment behaviour have focused on the role of instability and uncertainty in determining investment. Inflation as a symptom of macroeconomic instability is hypothesised to have a deleterious impact on investment and consequently, growth. Cyclical movement of rate of inflation and economic growth, especially in developing countries, has received much empirical attention among the economists, policy makers and the central bankers. A growing number of both theoretical and applied economists have devoted their time to the study of the conduct of monetary policy in recent years. The energizing impulse for the increasing theoretical and empirical research is two developments which stand out. First and foremost, advances in macroeconomic theory has been remarkable, with a new generation of quantitative models developed under the New Keynesian and monetarist paradigms that can be used to explicitly study the impact of inflation on stabilization and long-run economic growth.

High and sustained economic growth consistent with low inflation is the central objective of the macroeconomic policy makers (Khan and Senhadji, 2001). High rate of inflation negatively affects the real economic growth and thus causes adverse consequences for economic performance at the aggregate level and hence on growth. However, the nature of relationship between inflation and economic growth and the channels through which inflation affects real economic activities has remained a subject of academic controversy. Previous studies show mix evidence about the inflation-growth nexus. Few of these studies however show the existence of negative relationship (Barro, 1995; Faria and Carneiro, 2001), while others confirms positive relationship between inflation and economic growth (Lucas, 1973; Malik and Chowdry, 2001; Gillman et al. 2002, cited in Iqbal and Nawazi, 2012).

Recent literature, however, emphasise the existence of non-linear relationship between these two variables and supports the hypothesis that low and stable inflation promotes economic growth while higher inflation rates have significant negative effect on growth (Ghosh and Phillips, 1998; Khan and Senhadji, 2001 cited in Iqbal and Nawazi, 2012). This strand of literature highlights various channels through which inflation can affect economic growth in non linear fashion and investment might be considered as an important channel. Investment, inflation and economic growth non linear nexus can be explained by using financial market development. A predictable increase in the rate of inflation can slow down financial market development. Investment is the most important channel through which financial market affects economic growth (Li, 2006). Freidman (1977) argues that inflation disrupts the information mechanism of the price system and hence, halts the investment decisions of agents. This in turn, causes low investment and as a result, lowers growth.
Hence, inflation is costly not for its direct effect but also for its indirect effects that appear through inflation uncertainty channel (Khan and Rana, 2013).

Inflation as a tax on real balance reduces real returns to savings, value-reducing effects which in turn causes an informational friction afflicted the financial system via its uncertainty syndrome. These financial market frictions result in credit rationing and thus, limit the availability of investment and finally this reduction in investment adversely impacts economic growth. Choi et al. (1996) explains the non-linear effects of inflation on economic growth by positing that credit market frictions are potentially not detrimental at low rates of inflation. Thus, in low inflationary environments, credit rationing and information asymmetry might not emerge at all, and the negative link between inflation and capital accumulation vanishes. In such a case, higher inflation reduces the rate of return received by savers in all financial markets and consequently increases capital accumulation (Li, 2006, cited in Iqbal and Nawazi, 2012).

Uncertainty in financial markets, caused by inflation and inflation variability which results to low economic growth has become major macroeconomic problems for developing countries, including Nigeria. Some studies also envisage the existence of non-linear relationship between inflation and economic growth (Khan and Senhadji, 2001; Khan and Rana, 2012, cited in Iqbal and Nawazi, 2012; Aisien and Iyoha 2013). These studies focus on the existence of only one threshold level between these two variables by ignoring the possibility of second threshold in the relationship between inflation and growth. They completely ignore the channel through which inflation adversely impacts on growth. The literature highlights investment as the main channel through which inflation affects economic growth. With this in view, the objective of this study is to fill the gap in the literature by exploring the nature of relationship between inflation, investment and economic growth and to determine the inflation-growth threshold in Nigeria, particularly with the possibility of two thresholds as this appears not to have received any empirical attention.

The few studies on inflation threshold in Nigeria (Aisien and Iyoha, 2013; Bawa and Abdullahi 2012), only considered the subject matter in the context of the existence of only one threshold, ignoring the possibility of a second threshold. Other studies on the inflation-growth nexus in Nigeria (see Muritala, 2011; Inyiama, 2013) completely ignored the existence of inflation threshold and only considered inflation in terms of its impact on economic growth in a general context. It is this perceived literature gap that has made this study imperative. In addition, since as an indicator of macroeconomic stability, inflation rate assumes greater importance, it is imperative to understand the inflation threshold for macroeconomic management. In particular, since results from the other country-specific studies may not be applicable to Nigeria, an explicit understanding of the inflation-growth nexus in the context of threshold effects is thus beneficial to policy perspective as such will facilitate the objective of monetary and
financial integration Nigeria being a member-country in the West Africa Monetary Institute (WAMZ). In general, since the WAMZ is made up of small, open economies with similar structural peculiarities, shocks and macroeconomic problems, the policy implications will also be beneficial to the entire sub-region.

In light of the critical role of investment in propelling long-run economic growth and the fact that investment is the major channel through which inflation affects economic growth, it is therefore important to investigate the nexus between inflation, investment and economic growth, which is the main focus of this study.

Against this background, the following questions are pertinent to this study:

i. What is the relationship between inflation, investment and economic growth in Nigeria?
ii. Does a second threshold exist in the inflation-growth nexus in Nigeria?
iii. Does the effect of inflation on investment show a similar pattern to that of inflation on economic growth?

In line with the research questions therefore, this paper aims to achieve the following objectives:

i. Empirically examine the inflation-investment-growth nexus in Nigeria
ii. Empirically determine if a second threshold effect exists in the inflation-growth nexus in Nigeria and the impact of such thresholds.
iii. Investigate if the effects of inflation on investment (capital accumulation) show a similar pattern to that of inflation on economic growth.

Following the introductory section, section 2 discusses the experience of Nigeria relating to output growth and inflation, section 3 provides the literature review, while section 4 deals with the methodology, which includes the model specification as well as the data sources and description of the variables. The empirical results and analysis are discussed in section 5 and section 6 concludes the study and proffers policy recommendations.

2.0 INFLATION AND OUTPUT GROWTH IN THE NIGERIAN ECONOMY

The growth rate of GDP in Nigeria rose from 3.5 percent in the 1980s to 5.5 percent in the 1990s. This increase in growth has been attributed to both demand and supply-side factors. But it has been suggested that "Keynesian public expenditure-led growth (enhanced by oil revenues), or the increase in aggregate demand due to higher government spending and larger fiscal deficits, was primarily responsible for pushing up growth rates (Egwaikhide, Chete and Falokun, 1994)"
In the early 1980s, public investment was growing rapidly, but in the second half of the decade it slowed down and government consumption expenditure grew at a much faster pace. The revenue deficit grew, indicating that government consumption was being financed by borrowing, which entailed interest and repayment commitments. The success of expansionary fiscal policies in raising output growth, at least in the short run, can partly be attributed to the under-utilisation of productive capacity in the preceding years. By the end of the 1980s, when output was above trend levels, fiscal policy continued to be expansionary creating excess demand in the system (Nigeria Economic Report, 2013). The fiscal operations of the federal government resulted in large deficits averaging 1.93 percent of GDP between 1994 and 2008. From an average deficit of 1.56 percent of GDP for the period 1979-1994, it increased on average to 3.35 percent in 1999-2003 and then reduced to 0.86 percent of GDP in 2004-2008. A very remarkable feature of the government fiscal expansion was the financing of the excess expenditure from domestic and external sources.

Demand management aspects of SAP emphasize reduced public expenditures and, therefore, a fall in budget deficit. Although, budget deficit/GDP ratio peaked at 11.9 percent in 1986, it declined remarkably to 5.5 percent in 1987 and rose through 8.5 percent in 1988 to 9.0 percent in 1989. However, the magnitude of the fiscal deficit increased from almost N5.9 billion to N15.3 billion between 1987 and 1989. This was partly financed from bank credit, with the rapid growth of money supply as the inevitable concomitant (Egwaikhide et al., 1994).

It has been reported that it was not the balance of trade and import liberalisation but the developments in the capital account and the increasing element of higher interest on short-term loans that were responsible for the increasing balance of payment difficulties (Nigeria Economic Report, 2013).

Import compression and devaluation in the wake of SAP had a further adverse impact on inflation. When faced with a poor food grain crop, imports could not be used to supplement supplies. The rise in the prices of essential raw materials and capital machineries as a result of the depreciation generated inflationary expectations which spread to all sectors and encouraged inventory accumulation. Rising fiscal deficits and monetisation of an increasing part of the deficit in the late 1980s had created not only excess demand pressures but a liquidity overhang in the system. In Nigeria, several factors have been advanced to explain the changing external debt profile between the 1980s and now. The major factors include: high budget deficits, low output growth, large expenditure growth, high inflation rate and narrow revenue base witnessed since the 1980s. Short-term stabilisation measures were undertaken to restore macroeconomic balance, mainly by reducing aggregate demand and longer-term structural adjustments to the economy to increase productivity. Loans were negotiated with the IMF and the
Between 1980 and 1994, the inflation rate stood at 18.2 percent. Specifically, the inflation growth since 1970 has mostly been double digits. For instance, in 1980, inflation rate stood at 9.97 percent, but fell to 7.5 percent in 1990. Correspondingly, real output growth was 4.2 percent in 1980 and 8.1 percent in 1990. The aftermath of the Structural Adjustment Programme (SAP) of 1986 led to rapid growth in inflation rate to the tune of 10.2 percent in 1986, with an output growth of 2.51 percent. In 1995, inflation rate soared to an all high of 72.8 percent, the highest ever recorded in Nigeria, while real output growth rate was 2.5 percent. Inflation rate however fell precipitously to 29.29 percent in 1996 as a result of the contractionary (restrictive) monetary and fiscal policies adopted to quell the surge in inflation, with a real output growth rate of 4.3 percent.

Inflation rate stood at 6.9 percent in 2000, with a corresponding real output growth rate of 5.1 percent. By 2010, inflation was 10.8 percent, with a real output growth rate of 7.8 percent. In 2014 and 2015, the inflation rates were respectively 11.0 percent and 13.7 percent, with corresponding output growth rates of 6.5 percent and -1.2 percent, respectively occasioned by the oil price shock in the international market and the negative impulses and reverberations on the Nigerian economy.

**Table 1. Selected Economic Indicators**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
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<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
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</thead>
<tbody>
<tr>
<td>Real GDP Growth (%)</td>
<td>5.2</td>
<td>6.4</td>
<td>6.4</td>
<td>7.4</td>
<td>7.8</td>
<td>7.4</td>
<td>6.9</td>
<td>6.2</td>
<td>6.5</td>
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<tr>
<td>Oil GDP</td>
<td>1.0</td>
<td>1.5</td>
<td>-2.0</td>
<td>-6.1</td>
<td>-0.5</td>
<td>4.6</td>
<td>0.1</td>
<td>-0.7</td>
<td>1.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Non-Oil DP</td>
<td>5.0</td>
<td>5.6</td>
<td>5.7</td>
<td>9.0</td>
<td>8.3</td>
<td>8.5</td>
<td>8.8</td>
<td>7.9</td>
<td>5.7</td>
<td>4.3</td>
</tr>
<tr>
<td>Inflation Rate (CPI Average)</td>
<td>17.8</td>
<td>8.3</td>
<td>5.4</td>
<td>11.6</td>
<td>12.5</td>
<td>10.8</td>
<td>10.8</td>
<td>12.2</td>
<td>9.5</td>
<td>11.2</td>
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<tr>
<td>Gross Fixed Capital Formation (% of GDP)</td>
<td>25.6</td>
<td>28.0</td>
<td>30.2</td>
<td>28.7</td>
<td>30.3</td>
<td>29.7</td>
<td>26.3</td>
<td>31.2</td>
<td>30.5</td>
<td>32.7</td>
</tr>
<tr>
<td>Openness of the Domestic Economy</td>
<td>42.6</td>
<td>35.7</td>
<td>25.2</td>
<td>34.2</td>
<td>36.2</td>
<td>30.0</td>
<td>32.8</td>
<td>50.5</td>
<td>49.6</td>
<td>47.3</td>
</tr>
<tr>
<td>General Govt Fiscal Deficit* (% of GDP)</td>
<td>1.9</td>
<td>1.8</td>
<td>2.1</td>
<td>4.7</td>
<td>-6.6</td>
<td>-5.7</td>
<td>-2.2</td>
<td>-1.9</td>
<td>2.2</td>
<td>2.9</td>
</tr>
<tr>
<td>External Debt</td>
<td>6.1</td>
<td>7.3</td>
<td>8.1</td>
<td>2.2</td>
<td>2.4</td>
<td>2.0</td>
<td>2.3</td>
<td>2.5</td>
<td>11.2</td>
<td>9.5</td>
</tr>
<tr>
<td>Domestic Debt</td>
<td>9.9</td>
<td>11.2</td>
<td>7.8</td>
<td>9.4</td>
<td>13.0</td>
<td>13.0</td>
<td>14.8</td>
<td>15.9</td>
<td>17.1</td>
<td>19.3</td>
</tr>
</tbody>
</table>

**Source:** Computations by Author (2016): Underlying data from Nigerian Economic Report, CBN and WDI

*Include Federal, State, Local Extra-Budgetary Funds, Fuel Subsidy, Net Accumulation to ECA*
3.0 LITERATURE REVIEW

3.1. Theoretical Literature

3.1.1. Inflation and Investment

A budding number of theoretical literatures provide explanation on the inflation-investment nexus. Firstly, in endogenous growth theory, the growth rate depends on the rate of investment return and inflation has a dampening impact on the rate of return (Nelson, 1976; Fama and Schwert, 1977; and Boyd et al., 1996). Inflation reduces capital accumulation and hence decreases the growth rate. Secondly, inflation creates uncertainty in the financial markets and increases the risk associated with the investment which translates into lower economic activities (Hellerstein, 1997 cited in Iqbal and Nawazi, 2012). Inflation reduces capital accumulation since it erodes the value of money and other financial assets. Hence agents increase consumption and reduces savings. Accordingly, inflation shortens the planning horizon of the entrepreneurs as volatile prices make the predictions about the future costs and effective demand more difficult (Khan and Rana, 2013). Stockman (1981) shows that inflation reduces capital accumulation by increasing the cost of capital. He introduces a cash-in-advance (C.I.A) constraint on the representative agent to finance his consumption and investment expenditures. Since inflation compels the agent to economize the use of money for both consumption and investment purposes, it results to a negative relationship between inflation and capital accumulation and hence steady state capital stock. Haslag (1998) supports this view using a model where capital accumulation takes place through financial intermediation to channelize savings. Inflation increases reserve requirements for the financial institutions and, as a result, reduces capital accumulation (Ireland, 1994). Fischer (1993) provides empirical evidence with the finding that unstable macroeconomic environment, characterized by high inflation and inflation variability, reduces both capital accumulation and productivity. Inflation has a significant adverse effect on financial markets after certain level, but below which inflation has no significant effect on financial markets. There is range of inflation that significantly damages the financial market and beyond this; inflation will have no additional consequences for the financial sector performance or economic growth (Boyd and Smith, 1998; Huybens and Smith, 1998, 1999 and Boyd et al., 2001).

Financial market development is positively linked with the level of investment (King and Levine, 1993; Levine and Zervos, 1998 and Atje and Jovanovic, 1993). Thus, the adverse impact of inflation in financial market is directly translated into reduction in investment (Xu, 2000). Thirdly, inflation can discourage investors by reducing their confidence in investments that take a long time to mature in stock market. Fourthly, in an inflationary environment intermediaries will be less eager to provide long-term financing for capital formation and growth. The theoretical relationship shows the following transmission mechanism: Inflation adversely affects the financial market and
uncertainty in financial market translates into reduction of investment and this reduction in investment reduces economic growth.

3.1.2. Inflation and Economic Growth

Classical economists predict that the relationship between inflation and output is implicitly negative because, rise in prices lead to reduction in firm’s profit level through higher wage costs. Under Keynesian analysis, there is a short run trade off between output and change in inflation, but no permanent trade off between output and inflation. Monetarism suggests that in the long run, prices are mainly affected by the growth rate in money, while having no real effect on economic growth. Accordingly, if the growth in money supply is higher than the output growth rate, inflation results. Neo-classical economists present different views regarding the impact of inflation on economic growth. Mundell (1965) was one of the first to articulate a mechanism relating inflation and output growth separate from the excess demand for commodities and increased inflation, reduced people’s wealth. Tobin (1965) extended the Mundell (1965) model further and concludes that a higher inflation rate permanently raises the level of output. This predicts the positive relationship between inflation and economic growth (Choi et al. 1996 Sidrauski, 1967) analysis reveals that an increase in the inflation rate does not affect the steady state capital stock, so neither output change nor economic growth is affected. Stockman (1981) developed a model in which an increase in the inflation rate results in a lower steady state level of output and people’s welfare declines. This theoretical review demonstrates that models in the neo-classical framework can yield very different results with regards to inflation and growth. An increase in inflation can result in higher output (Tobin Effect) or lower output (Stockman Effect) or no change in output (Sidrauski Effect). Neo-Keynesians came with the idea of ‘Potential Output’ and according to this theory; inflation depends on the level of actual output (GDP) and the natural rate of unemployment.

Theory and evidence suggests that a low inflation rate is crucial for macroeconomic stability and long-term growth, as no country has achieved increased investment and sustained high growth in a persistently high inflation environment. Accelerating rates of inflation (a symptom of macroeconomic instability) has destabilizing effects on economic growth through its dampening impacts on savings, financial assets, capital accumulation and uncertainty syndrome (Ozekhome, 2016).

3.2. Review of Empirical Studies

3.2.1. Inflation and Investment

According to Barro (1995), decrease in economic growth occurs due to decrease in the propensity to invest that is caused by the dampening effects of inflation. His empirical results further show that an increase in average inflation by 10 percentage points per
year cause reduction in the ratio of investment to GDP by 0.4-0.6 percentage points and this reduction in investment reduces the real per capita GDP by 0.2-0.3 percentage points per year. So inflation reduces the level of investment and hence reduction in investment adversely affects economic growth.

Khan, Sehadji & Smith (2001) estimate the threshold level of inflation, for 168 countries by using NLLS estimation beyond which inflation had powerful negative effects on all measures of financial depth and below which inflation had insignificant or even positive effects on financial depth. They found that inflation between the range of 3 to 6 percent had negative impact.

McClain and Nichols (1994) employ newly developed time series techniques to test for a long-run relationship between inflation and investment by using U.S. time series data from 1929 to 1987. Unexpectedly, these authors found that investment and inflation are positively correlated to each other. They argued that this finding is consistent with the interpretation that the income effect of inflation increases savings, the incomplete Fisher effect lowers the real cost of funds, and that bond price movements from inflation increase real corporate wealth, all leading to higher real investment, not lower.

Li (2006) estimate the nonlinear relationship between inflation and investment for 27 developed and 90 developing countries over the period 1961-2004. He found that the efficiency of investment is the channel through which inflation adversely and nonlinearly affects economic growth. Moreover, at low to moderate inflation, specifically, below 65 percent for developing countries and below 42 percent for developed countries, inflation even has a significantly positive effect on the level of investment. These mixed empirical results suggest that the relationship between inflation and investment is rather mixed, therefore necessitating further empirical investigations.

Iqbal and Nawazi (2012) using evidence from threshold regression, examine the inflation-investment nexus for Pakistan over the period 1961-2008. The empirical results reveal that investment is one of the possible channels through inflation affect economic growth and the finding indicates a non-linear-relationship between these two variables with only one threshold at 7 percent. Rate of inflation below the threshold level is found to have a positive but insignificant impact, rates above the threshold have strong negative and significant impact on investment.

Ozekhome (2016) using a GARCH framework and Two Stage Least squares (2SLS) instrumental variable technique and quarterly time series data spanning the period 1981Q1-2013Q4 from Nigeria, finds that high inflation rates and inflation variability destabilizes investment (Gross capital formation). Against this background, the author recommends the implementation of sound macroeconomic policies as well as
institutional structures that will stimulate gross capital formation and enhance its relevance for rapid economic growth.

3.2.2. Inflation and Economic Growth

Barro (1995) investigates the inflation-economic growth relationship using a large sample covering more than 100 countries from 1960 to 1990. His results indicate that there exists a significant negative relationship between inflation and economic growth if country characteristics such as, fertility rate, education, etc. are held constant. More specifically, an increase the average inflation by 10 percentage points per year reduces the growth rate of real per capita GDP by 0.2 to 0.3 percentage points per year. In other words, his empirical analysis implies that the estimated relationship between inflation and economic growth is negative when some reasonable instruments are taken into cognizance in the statistical process. He concluded that higher long-term inflation reduces economic growth.

Bruno and Easterly (1995) examine the determinants of economic growth using annual CPI inflation of 26 countries which experienced inflation crises during the period between 1961 and 1992. In their empirical analysis, inflation rate of 40 percent and over is considered as the threshold level for an inflation crisis. They find inconsistent or somewhat inconclusive relationship between inflation and economic growth below this threshold level when countries with high inflation crises are excluded from the sample. In addition, the empirical analysis suggests that there exists a temporal negative relationship between inflation and economic growth beyond this threshold level. The robustness of the empirical results is examined by controlling for other factors such as shocks (e.g., terms of trade shocks, political crises, and wars). Finally, they find that countries recover their pre-crisis economic growth rates following successful reduction of high inflation and there is no permanent damage to economic growth due to discrete high inflation crises.

Sarel (1996) posits that most empirical studies conducted before the 1970s show the evidence of a positive relationship between inflation and economic growth, and a negative relationship between the two after that period due to the fact that inflation rates were somewhat modest in most countries before the 1970s and after that, accelerating inflation rates followed. Malla (1997) uses a small sample of Asian countries and countries belonging to the Organization for Economic Cooperation and Development (OECD) separately, finds, after controlling for labour and capital inputs that, for the OECD countries, there exists a statistically significant negative relationship between inflation and economic growth. However, the relationship is not statistically significant for the developing countries of Asia. The crucial finding of this empirical analysis suggests that the cross-country relationship between inflation and long-term economic growth experiences some fundamental problems like adjustment in country
sample and the time period. Thus, inconclusive relationship between inflation and economic growth can be drawn from comparing cross country time-series regressions with different regions and time periods.

Mallik and Chowdhury (2001) examine the short-run and long-run dynamics of the relationship between inflation and economic growth for four South Asian economies of Bangladesh, India, Pakistan, and Sri Lanka. Applying co-integration and error correction models to the annual data, the empirical findings reveal two motivating results. First, the relationship between inflation and economic growth is positive and statistically significant for all four countries. Second, the sensitivity of growth to changes in inflation rates is smaller than that of inflation to changes in growth rates. These results have important policy implications, that is, although moderate inflation promotes economic growth, faster economic growth absorbs into inflation by overheating the economy. Consequently, these four countries are on the turning point of inflation-economic-growth relationship.

Faria and Carneiro (2001) investigate the relationship between inflation and economic growth in the context of Brazil which has been experiencing persistent high inflation until recently. Analyzing a bivariate time series model (i.e., vector auto-regression) with annual data for the period between 1980 and 1995, they find that although there is a negative relationship between inflation and economic growth in the short-run, inflation does not affect economic growth in the long-run. Their empirical results also confirm the super-neutrality concept of money in the long run. This in turn provides empirical evidence against the view that inflation affects economic growth in the long run. Khan and Senhadji (2001) analysed the inflation and growth relationship separately for industrial and developing countries. The authors re-examine the issue of the existence of “Threshold” effects in the relationship between inflation and growth, using econometric techniques initially developed by Hansen (1999, 2000). They used the data set for 140 countries from 1960 to 1998. Their findings strongly suggested the existence of threshold beyond which inflation exerts a negative effect on growth. Inflation level below the threshold level has no effect on growth, while inflation rates above the threshold have a significant negative effect on growth.

Sweidan (2004) examines whether the relationship between inflation and economic growth has a structural breakpoint effect or not for the Jordanian economy from the period between 1970-2003. He finds that this relation tends to be positive and significant below an inflation rate of 2-percent and the structural breakpoint effect occurs at an inflation rate equal to 2-percent. Beyond this threshold level, inflation affects economic growth negatively. Mubarik (2005) estimates the threshold level of inflation for Pakistan using an annual data set for the period 1973 - 2000. He employed the Granger Causality test as an application of the threshold model and finally, the relevant sensitivity analysis of the model. His findings reveal that an inflation rate
beyond 9-percent is detrimental for the economic growth of Pakistan. This in turn, suggests that inflation rate below the estimated level of 9-percent is favourable for the economic growth. In addition, the sensitivity analysis performed for the robustness of the threshold model also confirms the same level of threshold inflation rate.

Ahmed and Mortaza (2005) empirically examine the relationship between inflation and economic growth in Bangladesh using co-integration and error correction models. The authors further investigate an interesting policy issue of what is the threshold level of inflation for the economy. The empirical evidence demonstrates that there exists a statistically significant long-run negative relationship between inflation and economic growth for the country as indicated by a statistically significant long-run negative relationship between CPI and real GDP.

Hussain (2005) empirically estimates the threshold level of inflation in Pakistan using annual data for the period 1973-2005. By using standard econometrics technique to estimate the threshold effect and suggests that targeting inflation exceeding a range of 4-6 percent will be deterrent to economic growth. He found no threshold level of inflation for Pakistan. These results are in sharp contrast to the findings of Mubarik (2005) where inflation threshold levels for Pakistan is at 9 percent. So according to him, for sustainable economic growth, inflation must be in the range of 4 and 6 percent.

Lee and Wong (2005) estimate the threshold levels of inflation for Taiwan and Japan using quarterly data set from the period between 1965-2002 for Taiwan and 1970-2001 for Japan. Their estimation of the threshold model reveals that an inflation rate beyond 7.25 percent is detrimental to economic growth in Taiwan. On the other hand, they found two threshold levels for Japan, which are 2.52 percent and 9.66 percent. This suggests that inflation rate below the estimated level of 9.66 percent is favourable to economic growth and beyond this threshold value, it is detrimental for economic growth.

Li (2006) estimate the non-linear relationship between inflation and economic growth for 27 developed and 90 developing countries over the period 1961-2004. In the context of developing countries, Li found the presence of two thresholds in the inflation-growth relationship. When the rate of inflation is below the first threshold, the effects of inflation on the economic growth rate is insignificant or even positive; at moderate rates of inflation, that is, rates of inflation between the two thresholds, the effects of inflation are negative and significant; at extremely high rates of inflation, the marginal impact of additional inflation on the economic growth diminishes rapidly but is still significantly negative. Furthermore, the first threshold level of inflation is estimated at 14 percent per year, and the second threshold level is estimated at 38 percent per year. For developed countries, only one threshold is detected and proved to be significant. This unique
threshold is estimated to be at 24 percent per year and works the same way as the second threshold for developing countries.

Munir and Mansur (2009) investigate the non-linear relationship between inflation rate and economic growth rate for the period 1970-2005 in Malaysia. The empirical findings indicate the existence of one inflation threshold value for Malaysia and strongly confirm the view that the relationship between inflation rate and economic growth is non-linear. The estimated threshold regression model suggests 3.89 percent as the threshold value of inflation rate above which inflation significantly retards growth rate of GDP. In addition, below the threshold level, there is statistical significant positive relationship between inflation rate and growth. Sergii (2009) investigate the growth-inflation interaction for CIS countries for the period of 2001-2008 and found that when inflation level is higher than 8 percent, economic growth is slowed down, otherwise, it is promoted. The non-linear growth inflation interaction is quite robust to the estimation method and specification.

Iqbal and Nawazi (2012) empirically examine the impact of inflation on investment and economic growth with two objectives. Firstly, the impact of the inflation rate on economic growth with the possibility of two threshold levels for Pakistan using annual data from 1961 to 2008 is examined and secondly, nonlinear relationship between inflation and investment is investigated. The empirical results reveal that inflation and growth model supports the existence of a nonlinear relationship with two thresholds (6 percent and 11 percent). Inflation below the first threshold is found to affect economic growth insignificantly and positively; at moderate rates of inflation, between the two threshold levels, the effect of inflation is significant and strongly negative and at high rates of inflation, above the second threshold, the marginal impact of additional inflation on economic growth diminishes but is still significantly negative. Investment is found to be one of the possible channels through which inflation affects economic growth and the empirical analysis indicates the existence of nonlinear relationship between these two variables with only one threshold at 7 percent. Rate of inflation below the threshold level has positive but insignificant impact, while above the threshold has strong negative and significant impact on the investment. The authors therefore concluded that it is desirable to keep the inflation below 6 percent because it may be helpful for the achievement of sustainable economic growth and investment.

Khan and Rana (2013) conduct a study explaining inflation-growth non-linearity through its impact on human and physical capital. The study sought to analyze the impact of inflation on the accumulation of physical and human capital using a large panel data of 104 countries over the period of 1971-2010. The empirical results, based on the instrumental variable (2SLS) model, substantiate the view that inflation enhances the accumulation of physical capital while it reduces the accumulation of human capital. Moreover, this relationship is found to be non-linear since the effects was reversed after
certain inflation thresholds. Finally, certain macroeconomic developments i.e financial
development and trade openness are found to increase the sensitivity of this relationship
between inflation and capital accumulation (both physical and human).

On studies relating to Nigeria, Muritala (2011) examine the investment-inflation growth
performance nexus in Nigeria over the period 1980-2006. Employing OLS technique,
his findings revealed that inflation has a significant deleterious impact on growth at the
10 percent level, while that of gross capital formation is positive and significant at the 1
percent level. His results (though did not consider threshold effects) further show that
a 1 percent increase in inflation will result to a reduction in economic growth performance by 0.1 percent. Similarly, a 1.0 percent change in investment (GCF) is
found to bring about 0.3 percent unit increase in economic performance. He concluded
that increased investment would induce consumption, labour productivity, output and
consequently economic performance because it will reduce capital flight. He
recommended the adoption of both supply-side policies and demand-management
policies to reduce inflation to propel economic growth in the short run and long-run.

Bawa and Abdullahi (2012) investigate the relationship between inflation and economic
growth in Nigeria in the context of threshold effect developed by Khan and Senhadji
(2001) and found a threshold inflation level of 13 percent. Below the threshold, inflation
is found to have mild effect on economic growth, while above it, the magnitude of the
negative effects of inflation on growth is high. Similarly, the negative and significant
relationship between inflation and economic growth below and above the threshold was
robust. He recommended sound monetary policy formulation as a guide for optimal
target for inflation consistent with long-term sustainable economic growth.

Inyiama (2013) examine the link between inflationary rate and economic growth in
Nigeria for the period 1979 to 2009. Employing cointegration, error-correction and
Granger Causality test, the findings (though did not consider threshold effects) reveal
that inflation has a significant negative impact on economic growth. He recommended
that efforts should be geared towards keeping inflation at a single digit in order to
enhance economic growth.

Aisien and Iyoha (2013) using evidence from threshold regression examine the
relationship between inflation and economic growth in Nigeria with quarterly time
series data for the period 1981-2012. Using non-linear least squares estimation
pioneered by Khan and Senhadji (2001), a non-linear relationship between inflation and
economic growth with an inflation threshold of 8 percent is found. The results further
show that up to the threshold, inflation has a positive and significant impact on growth.
The study, thus conclude that double digit inflation rate would retard economic growth
in Nigeria. According to the authors, since a key macroeconomic goal of Nigeria is to
achieve accelerated economic growth, appropriate policy should be put in place by the
Central Bank of Nigeria to reduce inflation rate to 8 percent or less. Rising inflation rate has diminishing impacts on investment and economic growth. Inflation destabilizes economic growth through its eroding effect on money, financial assets, capital accumulation and uncertainty syndrome.

3.3. Cross-Country Evidence on Inflation-Growth Nexus

Some recent studies have found cross-country evidence supporting the view that long term growth is adversely affected by inflation (Roubini and Sala-i-Martin 1992, Fischer, 1993). Countries (especially in Latin America) that have experienced high inflation rates have been found to have lower long-term growth (Cardoso and Fishlow 1989). This literature is imbued in the endogenous growth literature, which attempts to determine the causes of differences in growth rates in different countries. There is considerable evidence that investment is one of the most important determinants of long-term growth (Barro 1991; Levine and Renelt 1992). It is generally believed in the growth literature that a stable and conducive macroeconomic environment promotes growth by providing a more conducive environment for private investment.

In a recent study of the WAMZ countries, Adamu, Ighodaro & Iyoha (2012), found evidence of the destabilizing effects of inflation on growth. The militating effect of inflation on long-term growth was also corroborated by the findings of Ozekhome (2016) for ECOWAS countries. Against this background, both authors recommend sound and stable macroeconomic policy environment in order to propel rapid growth in ECOWAS countries. Among the reasons why high inflation is likely to be adverse for growth are:

i. Economies that are not fully adjusted to a given rate of inflation usually suffer from relative price distortions caused by inflation. Nominal interest rates are often controlled, and hence real interest rates become negative and volatile, discouraging savings. Depreciation of exchange rates lags behind inflation, resulting in variability in real appreciations and exchange rates.

ii. Real tax collections do not keep up with inflation, because collections are based on nominal incomes of an earlier year (the Tanzi effect) and public utility prices are not raised in line with inflation. For both reasons, the fiscal problem is intensified by inflation, and public savings may be reduced. This may adversely affect public investment.

iii. High inflation is unstable. There is uncertainty about future rates of inflation, which reduces the efficiency of investment and discourages potential investors.

The effect of macroeconomic instability on growth comes largely from the effect of uncertainty on private investment. Cross-country studies shows that macroeconomic instability, such as inflation instability and real exchange rate variability have
dampening impacts on investment, and hence, economic growth (Serven and Solimano 1992).

In a study of 17 countries, Cordon (1990) finds that although there are outliers, evidence generally supports the view that high growth is associated with low inflation. This is suggested both by cross-country evidence and comparison over time for countries where the rate of growth has fallen in relation to an increased rate of inflation. Fischer (1993) examines the role of macroeconomic factors in growth. He found evidence that growth is negatively associated with inflation and positively associated with good fiscal performance and undistorted foreign exchange markets. Growth may be linked to uncertainty and macroeconomic instability where temporary macroeconomic uncertainty causes potential investors to wait for its resolution, thereby reducing the investment rate (Pindyck and Solimano 1993). They however, noted that uncertainty and macroeconomic stability are difficult to quantify.

Fischer asserts that, since there are no good arguments for very high rates of inflation, a government that is producing high inflation is a government that has lost control. The inflation rate thus serves as an indicator of macroeconomic stability and the overall ability of the government to manage the economy. Inflation is theoretically posited to have an inverse relationship with economic growth. This is because, evidence suggests that macroeconomic stability is crucial for long-term growth as no country has achieved sustained high growth in a persistently high inflation environment (i.e. macroeconomic instability). Accelerating rates of inflation through its eroding effect and uncertainty syndrome have destabilizing effects on economic growth through the channels of savings, investment and its increasing uncertainty syndrome.

Fischer (1993) finds evidence that a stable macroeconomic environment, implying a reasonably low rate of inflation, a small budget deficit and an undistorted foreign exchange market, is conducive to sustained economic growth. He presents a growth accounting framework in which he identifies the main channels through which inflation reduces growth. He suggests that the variability of inflation might serve as a more direct indicator of the uncertainty of the macroeconomic environment. He however finds it difficult to separate the level of inflation from the uncertainty about inflation, in terms of their effect on growth. This is because the inflation rate and its variance are highly correlated in cross-country data. Evidence is in favour of the view that macroeconomic stability, as measured by the inverse of the inflation rate and the indicators of macroeconomic trends, is associated with higher growth. To examine the mechanism through which macroeconomic variables affect growth, Fischer regresses the rate of capital accumulation on these variables. The coefficient of the rate of inflation is found to be negative, suggesting that an important route through which inflation affects growth is the reduction of capital accumulation.
Fischer further finds that the inflation rate is negatively correlated with the rate of productivity growth measured by the Solow residual. He also examines the possibility that the above results are due to the inclusion in the sample of countries with very high inflation rates. When the inflation rate is broken into three categories—low (up to 15 per cent), medium (15 to 40 per cent) and high (above 40 per cent), the empirical results show that, contrary to what might have been expected, the association between inflation and growth and its determinants on average weakens as inflation rises. This supports the results obtained by Levine and Zervos (1992). Thus it is not the case that high inflation explains the overall negative correlations between inflation and growth, capital accumulation and productivity growth. Rather, Fischer’s results suggest that the association between growth, inflation and capital accumulation is stronger at the low and moderate levels than at high inflation. De Gregorio (1993) using evidence from 12 Latin American countries over the period 1950–85, finds a significant negative correlation between inflation and growth. Though both inflation and its variance have negative effects on growth, since they are highly correlated in cross-country evidence, the results cannot discriminate whether it is the level or the variability that negatively affects growth. Even when high inflation countries were eliminated from the regression, the impact of inflation was both negative and significant. However, though results suggest a negative relation between inflation and investment in physical capital and foreign investment, the relationship is not significantly different from zero. Though Fischer’s results suggest that inflation affects the level of investment, De Gregorio (1993) finds that it is the efficiency of investment that is affected and that is what feeds into the effects of inflation on growth. This result is supported by cross-country evidence presented in Levine and Renelt (1992).

Bleaney (1996) finds that poor macroeconomic policy, measured by fiscal balance, real exchange rate volatility is negatively correlated with growth. His results reveal that inflation is positively correlated with the real exchange rate and when included in the same regression inflation does not appear to have a negative influence on growth. Since the two are correlated, the implication is that that the choice of one of the two variables may depend on the degree of openness and the relative influence of the domestic and foreign prices for investment decisions. High inflation rates also tend to be volatile and the associated negative and unpredictable real interest rates discourage domestic financial savings. Unanticipated high inflation erodes the real value of financial assets and the volatility of inflation increases the risk associated with holding them. Conversely, low-to-moderate inflation, particularly at stable rates, encourages financial savings.

Fry (1988) and Gleb (1989), cited in Patnaik and Joshi, (2012) using pooled cross-economy time series data, find evidence of a consistently positive and significant relationship between economic growth and the real rate of interest. To separate the effects of inflation in a financially repressed regime from those of real interest rates, a
World Bank study re-estimates the equations (World Bank 1993). Evidence from a sample of twenty countries, for the impact of the real interest rate and the inflation rate on the GNP growth rate is found. The real interest rate has a statistically significant and positive impact on growth. But when inflation is included, the coefficient for the real interest rate is no longer statistically significant, while the negative coefficient on the rate of inflation is. This suggests that the positive relation between real rate of interest and growth was actually reflecting a negative relation between inflation and growth in financially repressed regimes, where nominal interest rates are kept fixed. Perhaps that is why, for a subsample of economies for which real interest rates are positive, the coefficients of both the real interest rate and inflation are negative, indicating that lower real interest rates may have had a positive impact on growth. The study also suggests that another critical variable that influences investment was public investment in infrastructure (social and economic infrastructure). If inflation reduces public saving, public investment is likely to fall. (Patnaik and Joshi, 2012).

4.0. METHODOLOGY

4.1 Model Specification

The relationship between inflation and economic growth can be derived using the approach by (Barro, 1991 and Martin, 1997) and subsequently adopted by Iqbal and Nawazi (2012) as:

\[ \text{dlogGDP}_G = \alpha_0 + \alpha_1 \text{INF} + X \beta + \varepsilon \] ...................................(1)

Where \( \alpha \) is a measure of a real output, \( X \) is a vector of explanatory variables that affects growth, \( \beta \), is the slope coefficients and \( \varepsilon \), is the error term.

This basic growth model is extended to capture the link between inflation and economic growth in the following linear regression model specified as:

\[ \text{dlogGDP}_G = \alpha_0 + \alpha_1 \text{INF} + X \beta + \varepsilon \] ...................................(2)

Where: \( \text{dlogGDP}_G \) is the growth rate of real GDP, \( \text{INF} \) is inflation rate, measured as growth rate of consumer price index, and \( X \) is matrix of other explanatory variables, \( \beta \), is matrix of slope coefficients and is \( \varepsilon \), the error term.

Neoclassical growth model uses investment and population growth in the regression equation as increase in investment together with a decrease in population growth rate promotes economic growth. International trade theory proposes to include openness of the economy in the growth regression which is positively related to growth. Money supply is an important indicator for financial development. Thus, our empirical analysis uses the following explanatory variables: investment, population growth, \( M_2 \) to GDP.
and openness of the economy. This choice of variables is consistent with the pattern previously used by other researchers (Khan and Senhadji, 2001; Sergii, 2009; Iqbal, 2012).

Incorporating these variables, the following model is specified:

\[
d\log GDP_G = \alpha_0 + \alpha_1 (\text{INF}) + \beta_1 (\text{POPG}) + \beta_2 (\text{INVY}) + \beta_3 (\text{FD}) + \beta_4 (\text{OPN}) + \varepsilon \tag{3}
\]

Where: \( d \log GDP_G \) is growth rate of real GDP, \( \text{INF} \) is growth rate of consumer price index (CPI), \( \text{POPG} \) is population growth rate, \( \text{INVY} \) is investment to GDP ratio, \( \text{FD} \) is financial development measured as \( \frac{M2}{GDP} \) ratio, \( \text{OPN} \) is openness of the domestic economy measured as \( \frac{(\text{Export} + \text{Import})}{GDP} \) and \( \varepsilon \) is the error term.

As discussed earlier, theoretical and empirical studies predict that threshold effects are associated with a rate of inflation exceeding some “critical value” or below some “critical value”. Threshold Model was developed by Khan and Senhadji (2001) for the analysis of threshold level of inflation for industrialized and developing countries. Mubarik (2005) and Iqbal and Nawiz (2012) use the same model for the estimation of threshold level of inflation in Pakistan.

By introducing the possibility of two threshold level of inflation; the final regression equation is captured as:

\[
d\log GDP_G = \alpha_1 + \alpha_2 (\text{INF}) * I(\text{INF}<\pi_1) + \alpha_3 (\text{INF}) * I(\pi_1 \leq \text{INF} \leq \pi_2) + \alpha_4 (\text{INF}) * I(\text{INF}>\pi_2) + \beta_1 (\text{POPG}) + \beta_2 (\text{INVY}) + \beta_3 (\text{FD}) + \beta_4 (\text{OPN}) + \varepsilon \tag{4}
\]

Where: dependant variable and the control variable are defined as the same as in equation (3) while (1) and (2) are two thresholds level of inflation. I (\text{INF}<\pi_1), I (\pi_1 \leq \text{INF} \leq \pi_2), and I (\text{INF}>\pi_2) are indicators functions which take the value of one if the term between parentheses is true and zero otherwise.

This model specifies the effects of inflation with three coefficients: \( \alpha_2, \alpha_3 \) and \( \alpha_4, \alpha_2 \) denoting the effect of inflation below the first threshold level \( \pi_1 \), \( \alpha_3 \) denotes the effect of inflation on economic growth between \( \pi_1 \) and \( \pi_2 \), and \( \alpha_4 \) denotes the effect of inflation on economic growth exceeding the second threshold level \( \pi_2 \). Identification of threshold is based on the methodology defined by Khan and Senhadji (2001). Regression equation is estimated for different values of threshold which is chosen in an ascending order (i.e., 1, 2 and so on), the optimal value threshold is obtained by finding the value that maximizes the \( R^2 \) from the respective regressions. This also implies that the optimal threshold level is that which minimizes the residual sum of squares (RSS). This procedure has become widely accepted in the literature on inflation-growth nexus (Iqbal and Nawazi 2012). Search of optimal threshold for wider range of threshold is
very tedious. Moreover, Hansen (2000) proposed to search optimal value only in the region where we do expect the threshold should be. Graphical analysis is also used to narrow the range of values for inflation threshold. Theoretical literature has suggested that investment might be the channel from inflation to economic growth. Following this, a linear model specification is used to measure the linear relationship between investment and inflation:

\[ \text{INV} = \delta_0 + \delta_1 \text{INF} + \delta_2 \text{INV}_{t-1} + \varepsilon \]  

(5)

Where: \( \text{INV} \) is the gross fixed capital accumulation as share of GDP and first lag of \( I \) is included to control the economic conditions in the last period (Li, 2006).

For non-linear the following regression equation is used:

\[ \text{INV} = \delta_1 + \delta_2 (\text{INF}) \times I(\text{INF} < \pi_1) + \delta_3 (\text{INF}) \times I(\pi_2 \leq \text{INF} \leq \pi_2) + \delta_4 (\text{INF}) \times I (\text{INF} > \pi_2) + \delta_5 (\text{INV}_{t-1}) + \varepsilon \]  

(6)

Selection of threshold level is based on the similar procedure explained as above.

4.2. Data Sources and Variables Description

The data for this study are obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (various editions), and National Bureau of Statistics (NBS). Data covers the period 1980 to 2014 and consists of the following variables. Inflation is measured as annual percent change of average consumer price index; Population growth rate is measured as annual population growth rate, Investment is measured as gross fixed capital formation as percent of GDP and Openness is measured as share of export plus import in GDP.

5.0. EMPIRICAL RESULTS AND ANALYSIS

The empirical analysis that is performed in this chapter involves the estimation and succinct analysis of the model that was specified in the previous section. However, in order to examine the characterization as well as correlation among the variables used in the regression analysis, we carry out the descriptive and correlation analysis, before conducting the unit root test and subsequent econometric estimations.

5.1 Descriptive Statistics

Table 2 presents the descriptive statistics of the sample data on the variables used for the analysis. The descriptive statistics show that the mean value of growth rate of GDP is 9.16 percent while its median value is 6.15 percent. The mean value of investment to GDP ratio is 11.02 percent. Inflation has a mean value of 10.52 percent and population
growth has a mean value of 4.25 percent. M2 as share of GDP has a mean value of 13.7 and openness has a mean value of 18.21. The relative high values of investment to GDP, M2 to GDP and openness underscore their pronounced critical role in driving economic growth. Further buttressing this fact is their relative high maximum values. Apparently, these variables have high multiplier effect on growth. In terms of the standard deviation, inflation is seen to have the highest value of 5.5 over the sample period—an indication of inflation variability in Nigeria. The kurtosis values also indicate normality in distribution over the period for all the variables, except inflation with a value of -1.62, a further attestation to inflation instability during the reference period.

Table 2. Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Max.</th>
<th>Min.</th>
<th>Std. Dev.</th>
<th>Skew</th>
<th>Kurt.</th>
<th>J-B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GDP</strong></td>
<td>9.16</td>
<td>6.15</td>
<td>25.18</td>
<td>4.61</td>
<td>2.16</td>
<td>2.21</td>
<td>4.05</td>
<td>4.25</td>
</tr>
<tr>
<td><strong>INV</strong></td>
<td>11.02</td>
<td>2.22</td>
<td>24.02</td>
<td>3.41</td>
<td>1.29</td>
<td>1.30</td>
<td>3.60</td>
<td>2.30</td>
</tr>
<tr>
<td><strong>INF</strong></td>
<td>10.52</td>
<td>3.04</td>
<td>15.21</td>
<td>-0.98</td>
<td>5.50</td>
<td>-1.25</td>
<td>-1.62</td>
<td>3.12</td>
</tr>
<tr>
<td><strong>POPG</strong></td>
<td>4.25</td>
<td>5.26</td>
<td>16.12</td>
<td>2.25</td>
<td>2.25</td>
<td>1.95</td>
<td>3.20</td>
<td>3.10</td>
</tr>
<tr>
<td><strong>FD</strong></td>
<td>13.70</td>
<td>6.50</td>
<td>22.27</td>
<td>3.19</td>
<td>4.45</td>
<td>1.75</td>
<td>3.19</td>
<td>2.52</td>
</tr>
<tr>
<td><strong>OPEN</strong></td>
<td>18.21</td>
<td>9.20</td>
<td>28.15</td>
<td>5.32</td>
<td>4.50</td>
<td>2.33</td>
<td>5.50</td>
<td>3.21</td>
</tr>
</tbody>
</table>

5.2 Correlation Analysis

In order to examine the correlation between the variables used in the analysis, we conduct the correlation analysis. The result of the correlation tests are reported in table 3 below. In the correlation matrix, a positive relationship is observed between GDP growth rate and all the variables (except inflation), an indication that these variables invariably stimulate higher economic growth, with that of inflation having a destabilizing effect on growth. The correlations between the explanatory variables indicate that inflation is negatively correlated with investment, while all other variables are positively correlated with each other.
Table 3: Correlation Results

<table>
<thead>
<tr>
<th></th>
<th>GDPG</th>
<th>INVY</th>
<th>INF</th>
<th>POPG</th>
<th>M2/GDP</th>
<th>OPENNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INVY</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INF</td>
<td>-0.27</td>
<td>-0.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POPG</td>
<td>0.15</td>
<td>0.38</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FD</td>
<td>0.58</td>
<td>0.57</td>
<td>0.36</td>
<td>0.038</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPEN</td>
<td>0.42</td>
<td>0.12</td>
<td>0.17</td>
<td>0.09</td>
<td>0.30</td>
<td></td>
</tr>
</tbody>
</table>

5.3 Unit Root Analysis

A time series is stated as non-stationary if its mean and variance is dependent over time. On the other hand, a time series is regarded as stationary if the mean and variance is time-invariant and constant over time. Using the Augmented Dickey Fuller (ADF) test, the results of the unit root is presented in levels and first difference in table 4 below:

The result indicates that the variables were initially non-stationary at levels. In line with the argument of Box and Jenkins (1978) that non-stationary time series in levels may be made stationary by taking their first differences, we took the first differences of the respective variables and performed the unit root test on each of the resultant time series. Since the variables were not stationary except after first differencing, we used their first differences.
Table 4. Unit Root Test for Variables in First Difference

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels</th>
<th>Remarks</th>
<th>First Difference</th>
<th>Order</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPG</td>
<td>-1.2572</td>
<td>Non-Stationary</td>
<td>-5.3196**</td>
<td>I(1)</td>
<td>Stationary</td>
</tr>
<tr>
<td>INVY</td>
<td>-1.6342</td>
<td>Non-Stationary</td>
<td>-4.4492*</td>
<td>I(1)</td>
<td>Stationary</td>
</tr>
<tr>
<td>INF</td>
<td>-1.7905</td>
<td>Non-Stationary</td>
<td>-3.2544*</td>
<td>I(1)</td>
<td>Stationary</td>
</tr>
<tr>
<td>POPG</td>
<td>-1.0613</td>
<td>Non-Stationary</td>
<td>-5.2115**</td>
<td>I(1)</td>
<td>Stationary</td>
</tr>
<tr>
<td>FD</td>
<td>-2.2370</td>
<td>Non-Stationary</td>
<td>-4.2142*</td>
<td>I(1)</td>
<td>Stationary</td>
</tr>
<tr>
<td>OPN</td>
<td>-2.9945</td>
<td>Non-Stationary</td>
<td>-3.1729*</td>
<td>I(1)</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

* significant at the 5%
** significant at the 1%

Table 5. Linear Estimation: Dependent Variable is GDP Growth Rate

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1.0652</td>
<td>1.7231</td>
</tr>
<tr>
<td>INF</td>
<td>-0.1546</td>
<td>2.9744</td>
</tr>
<tr>
<td>INV</td>
<td>0.5205</td>
<td>3.2192</td>
</tr>
<tr>
<td>FD</td>
<td>0.1159</td>
<td>1.7698</td>
</tr>
<tr>
<td>OPN</td>
<td>0.2527</td>
<td>2.3814</td>
</tr>
<tr>
<td>POPG</td>
<td>0.292</td>
<td>2.5314</td>
</tr>
</tbody>
</table>

R-Squared= 0.65; DW Statistic=1.97
Jaque-Bera RESET Test= 0.62
Ramsey test= 1.45 [0.46]

Inflation and Economic Growth Nexus

The simple linear model of inflation-growth nexus as defined in equation (3) has been estimated. The cardinal aim of the simple linear regression is to reveal the shape of the growth function linking inflation with economic growth. The estimation is done using data for Inflation and GDP growth and other control variables from 1980 to 2014 as shown in (Table 5). Given the coefficient of determination 0.65, it is invariably clear that about 65 percent of the systematic variations in economic growth is explained by the explanatory variables. The DW Statistic indicates the absence of serial correlation in the model, making the model reliably fit for policy perspective. Inflation has significant negative impact on economic growth. This supports the findings of Mubarak (2005), Hussain (2005), Iqbal and Nawaz (2012) for Pakistan and, Bawa and Abdullahi (2012) and Aisien and Iyoha (2013) for Nigeria. Investment has positive and significant impact.
on economic growth. Openness has a positive and significant influence on economic growth and population growth also has positive and significant impact on economic growth. The impact of M2 to GDP ratio is positive (though insignificant), an indication of low level of financial development, except for the sweeping financial sector reforms in recent time. The coefficient of investment /GDP ratio is 0.52, indicating that a 1 percent increase in investment will cause a 0.52 percent increase in growth. That of inflation shows that a 1 percent increase in inflation will reduce growth by 0.15 percent, while that of openness, M2 to GDP ratio and population growth will stimulate economic growth by 0.25 percent, 0.12 percent and 0.29 percent respectively. Nonlinear model has been estimated using equation 4. For estimation of (1), we apply the methodology used previously. The following steps are involved in estimation on nonlinear model. In the first step, we estimate the equation 3 with one threshold level. The estimation process of $\pi_1$ is the same as given in section 5.

$$ \text{dlog GDPG} = \alpha_1 + \alpha_2 (\text{INF})* I(\text{INF} \leq \pi_1) + \alpha_3 (\text{INF})* I(\text{INF} > \pi_1) + \beta_1 (\text{POPG}) + \beta_2 (\text{INVY}) + \varepsilon $$

We apply a range of threshold level ranging from 1 to 8 and select the value that minimizes the error sum of square in line with the position by Hansen (2000) and subsequently followed by other threshold studies e.g. Iqbal and Nawazi (2012).

The result indicates that the value of 1 is 6 and inflation below 6 has positive impact on economic growth. These findings of first threshold level are also consistent with Singh (2003) for India, Hussain (2005) and Iqbal and Nawazi (2012) for Pakistan Aisien and Iyoha (2013) and Bawa and Abdullahi (2012) for Nigeria. Thereafter, we carry out a significant test of no threshold against one threshold. The null hypothesis is $H_0: \alpha_2 = \alpha_3$ against the alternative of $H= \alpha_2 \neq \alpha_3$. The result indicates that null hypothesis is rejected at 5 percent level of significance which confirms the existence of one threshold level in inflation data.

The existence of second threshold in the relationship between growth and inflation is tested by using equation 4. By using same process, we find the second threshold level which is 12 in this case (Table 6). Then, we carry out a significant test of one threshold against two thresholds. The null hypothesis is existence of only one threshold against the alternative of existence of two thresholds. The result supports the existence of two thresholds against one at 5 percent level of significance.
Table 6. Estimation with Threshold Effect: Dependent Variable is GDP Growth Rate

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.9864</td>
<td>-1.4570</td>
</tr>
<tr>
<td>Inflation&lt;6</td>
<td>0.1025</td>
<td>0.7869</td>
</tr>
<tr>
<td>Inflation ≥6 and Inflation ≤12</td>
<td>-0.3395</td>
<td>-2.7712</td>
</tr>
<tr>
<td>Inflation&gt;12</td>
<td>-0.2908</td>
<td>-2.9551</td>
</tr>
<tr>
<td>Investment</td>
<td>0.1590</td>
<td>2.6229</td>
</tr>
<tr>
<td>FD</td>
<td>0.1025</td>
<td>1.9263</td>
</tr>
<tr>
<td>OPN</td>
<td>0.2171</td>
<td>2.2430</td>
</tr>
<tr>
<td>POPG</td>
<td>0.0862</td>
<td>2.5028</td>
</tr>
</tbody>
</table>

R-Squared = 0.61; DW Statistic = 2.11
Jaque-Bera RESET Test = 0.48
Ramsey test = 1.19 [0.3]

The final estimation results of equation 4 are presented in table 6. An interesting finding is that for the low inflation, the coefficient of inflation (0.1025) is positive. This result shows that a 1 percentage increase in inflation will cause a 0.10 percentage point increase in economic growth. However, this positive impact is not significant.

This implies that in Nigeria, low inflation up to 6 is not harmful for the country. In the middle inflation category (inflation between 6 and 12), the coefficient of inflation (-0.3395) is negative and significant at one percent level. This finding corroborates the results of Aisien and Iyoha (2013) of a single inflation threshold of 8 percent for Nigeria, since the mean inflation threshold between the two thresholds (6 percent and 12 percent) is 9 percent—a level immediately above the 8 percent in which further rise beyond the 8 percent inflation threshold has significant deteriorating effect on growth. Accordingly, an increase in one percentage point inflation per year is associated with a deteriorating growth rate of real GDP by 0.34 percentage point. When inflation rate is exceeding the 12 percentage point, the coefficient of inflation is more negatively significant at the 1 percent level. This, negative effect is however lower than that when inflation is in the range of 6 to 12. A 1 percent increase in inflation, when inflation rate is more than 12 percent, leads to a reduction of 0.29 percent in real GDP growth rate.

The existence of two threshold level implies that inflation can be divided into three parts. As inflation rises from zero to 6 percent, the effect on economic growth is negligible or even positive. As inflation crosses the low threshold level, it has a significant and negative (deteriorating) impact on the GDP up to a certain level. When inflation exceeds the second threshold level, the marginal adverse impact of inflation on growth diminishes. Thus, accelerating rate of inflation has diminishing marginal destabilizing effects on growth in Nigeria, as the adverse effect would already have slowed economic activities. This findings is corroborated by findings of Hussein (2005), Li (2006) for a group of developed and developing countries, and Nasir and Iqbal (2012) for Pakistan and Singh 2003) for India.
The smaller negative coefficient illustrates that the inflation growth relationship flattens when the economy has high inflation. Intuitively, we can conclude that once inflation exceeds a threshold level, all of the damage to the financial system has already been done; consequently, perfect foresight dynamics comes into being. When these occur, further increases in inflation have no additional detrimental effects on economic growth, but the impact is still negative and significant.

**Inflation and Investment Nexus**

Theoretical literature has posited that investment serves as the channel that through which inflation affects economic growth. The linear model is estimated by using equation (5) to examine the relationship between inflation and investment.

An examination of the result shown in table 7 below indicates that inflation has significant and negative impact on investment/GDP ratio. The coefficient of inflation (-0.0548) shows that a 1 percentage point increase in inflation will cause a 0.05 percent reduction in investment. The first lag of investment is used to account for the effect of economic conditions in the last period which has significant and positive impact on current investment. This linear analysis confirms the inflation-investment nexus like that of inflation and GDP growth. Further relationships between inflation and investment with threshold effects by using the same techniques described for inflation and economic growth is estimated.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.5932</td>
<td>-2.3691</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.0548</td>
<td>-2.3160</td>
</tr>
<tr>
<td>Lag of Investment</td>
<td>0.6109</td>
<td>-2.8542</td>
</tr>
</tbody>
</table>

R-Squared= 0.53; DW Statistic=1.87
Jaque-Bera RESET Test= 0.11
Ramsey test= 1.18 [0.33]

Nonlinear model estimation began by estimating the equation 6. By applying the same approach as given for inflation and growth, a single threshold at 7 percent is estimated since we cannot reject the null hypothesis of one threshold against two thresholds. This finding is in line with the findings for Nigeria by Aisien and Iyoha (2013) for a single threshold.
This result is economically plausible given that the inflation-growth threshold effect as a matter of theory and evidence should be lower than that of inflation-investment threshold, since investment constitutes the channel through which inflation affects economic growth. As a result, investment serves as direct channel through which inflation affects growth (pass-through variable). Inflation will thus affect investment first before affecting growth, which makes the value of the effect of inflation threshold on investment of a higher magnitude.

Table 8 presents the estimation results of the inflation-investment relationship with threshold effects. The coefficient of inflation (0.1068) is insignificantly positive when inflation is below the threshold level. However, as inflation rates exceed the threshold level, the effect of inflation on the level of investment is negative and significant. The evidence suggests that during a period of high inflation, the level of investment is adversely affected by inflation.

Thus, high level of inflation has a destabilizing effect on investment. Investment thus serves as a potential transmission channel through which inflation affects economic growth.

### Table 8. Estimation with Thresholds Effects: Dependent Variable is GDP Growth Rate

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.0692</td>
<td>2.4745</td>
</tr>
<tr>
<td>Inflation&lt;7</td>
<td>0.1068</td>
<td>0.8769</td>
</tr>
<tr>
<td>Inflation&gt;=7</td>
<td>-0.0574</td>
<td>-2.7625</td>
</tr>
<tr>
<td>Lag of Investment</td>
<td>0.7295</td>
<td>3.1726</td>
</tr>
</tbody>
</table>

R-Squared= 0.56; DW Statistic=1.77
Jaque-Bera RESET Test= 0.07
Ramsey test= 0.15 [0.76]

### 6.0. CONCLUSION AND POLICY PERSPECTIVE

Macroeconomic stability and the necessary infrastructure are among the condition-precedents for sustained growth. Investment constitutes an important channel through which inflation affects economic growth. Low or moderate inflation is an indicator of macroeconomic stability and creates an environment conducive for investment, as accelerating rates of inflation undermines growth. A review of the existing cross-country international evidence, as well as evidence from developing countries, indicates a negative relationship between inflation and long-term growth. Countries with low or moderate rates of inflation have higher growth rates over the long-term compared with countries with high inflation rates. However, low inflation does not constitute a
sufficient condition for growth, as it must be complemented with increasing investment, sound macroeconomic policies and institutional structures.

The objective of the present study has been twofold. Firstly, the impact of the inflation rate on economic growth with the possibility of two threshold level for Nigeria using annual data from 1980 to 2014 has been examined and secondly, nonlinear relationship between inflation and investment is also investigated. Inflation and growth model supports the existence of a nonlinear relationship with two thresholds (6% and 12%). Existence of double threshold, divide the inflation range into three categories i.e. low inflation, moderate inflation and high inflation. Inflation below the first threshold (6%) affects economic growth positively, at moderate rates of inflation, between the two threshold levels (6% to 12%), the effect of inflation is significant and strongly negative and at high rates of inflation, above the second threshold (above 12%), the marginal impact of additional inflation on economic growth diminishes but is still significantly negative. The existing literature emphasizes only one threshold level beyond which inflation impedes growth, but below which inflation has no significant or even positive effects on growth. This study however finds evidence of a second threshold level for Nigeria. The finding of first threshold level is also consistent with those of developing countries such as Singh (2003) for India, Hussain (2005), and Iqbal and Nawiz (2012) for Pakistan.

The second objective of the study is to investigate the mechanism through which inflation affects long-run economic growth in a non-linear fashion. Investment is one of the possible channels through which inflation affect economic growth and the analysis indicates the nonlinear relationship between these two variables with only one threshold at 6%. Rate of inflation below the threshold level has positive but insignificant impact, while above the threshold has strong negative and significant impact on the investment. These findings provide some important policy implications. On the basis of this study, it is desirable to keep the inflation rate below 6 percent. Therefore, central bank should implement sound non-inflationary macroeconomic policies as well as inflation targeting mechanisms that will keep the inflation rate below the first threshold, since such will be helpful for the achievement of sustained economic growth and overall macroeconomic stabilisation. Low inflation is also helpful for minimizing the uncertainties in the financial market which in turn enhances investment and overall economic growth. Sound investment-enhancing policies coupled with stable and coherent complementary macroeconomic policies and institutional structures should be put in place in order to propel rapid economic growth in Nigeria.
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Khan, M. and Rana, T. (2013). Explaining inflation-growth non-linearity through its impact on human and physical capital accumulation. Laboratoire d’Economie d’Orleans (Leo), Universite, d’ Orleans, Rue de Blois, BP: 6739-45067-Orleans-Cedex 2, France.


