

Analysis of the Main Determinants of Inflation in Nigeria

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Abstract

The retard economic growth in Nigeria is associated with macroeconomic instability variables, in particular, the unstable rate of inflation. Consequently, the pursuance of poverty reduction and economic prosperity policy targets remained elusive. This study investigated the main determinants of inflation in Nigeria for the period 1986 – 2011. The Augmented Dickey-Fuller unit root statistics test revealed that all the variables are stationary after first and second difference at 5% level of significance. The co-integration result reveals long-run equilibrium relationship between the rate of inflation and its determinants. The Granger causality test revealed evidence of a feedback relationship between inflation and its determinants. The estimated VAR result showed that fiscal deficits, exchange rate, import of goods and services, money supply and agricultural output have a long run influence on inflation rate in Nigeria. Only lending rate influenced inflation in the short and long run horizon. The variance decomposition and impulse response results show that “own-shocks” were significantly responsible for the variation and innovations in all the variables in the equation. Obviously, inflation in Nigeria is fiscal and monetary policy influence. While this study discourages excessive waste of public funds through fiscal deficit, it recommends that the monetary authority should encourage a lending rate policy that promotes investment as well as retention of a desired level of money supply and interest rates that reduce inflation rate in Nigeria. More so the authorities should greatly be proactive in financing agricultural and manufacturing sector to increase local production of competitive goods that appreciate the Nigeria naira currency in relation to major international currencies.

Keywords: Inflation, Fiscal policy, Monetary policy, Agriculture, Econometric tools.

1. Introduction

An economy that is faced with 3 to 6 per cent rate of inflation may experience positive economic effect. Inflation encourages investment and production and as such increase growth in wages and consumption. But, a high inflation rate in the range of double digit may produce a negative economic effect. This will adversely affect purchasing power of the consumer. It can lead to uncertainty of the value of gains and losses, borrowers and lenders as well as buyers and sellers (Abdul, Syed and Qazi, 2007). Furthermore, higher level of inflation creates uncertainty which discourages savings and investment. Savings are discouraged as inflation reduces the real rate of return on financial assets. This again leads to low investment and a declining economic growth. High inflation rate erodes the gains from growth and leaves the poor worse off thereby increase the divide between the rich and poor in the society. A high inflation rate result from increase in food prices, it hurts the poor because of their high marginal propensity to consume.

The main target of every nation's monetary and fiscal policies, whether a developed or less developed nation has been the maintenance of a low and relatively stable rate of aggregate inflation. Economic stability is often regarded as the baseline for the realization of macroeconomic objectives (Metwally and Al-Sowaidi, (2004)). In the last two decades, the inflation rate in Nigeria has assumed different dimensions and accelerated considerably. Non-stationary price path introduces uncertainty in the objective function of economic agents, reduces economic efficiency and consumer welfare. This is the reason why inflation as a macroeconomic variable or phenomenon has received much attention in recent time.

Inflation is usually the result of the interplay of many factors. The Nigerian economy immediately after the civil war progressed rapidly in the large inflow of petrodollars courtesy of the crude oil boom of the early 1970s. The large petrodollar allowed investment expenditure to increase rapidly and thus, the purchasing power rose significantly for a number of persons in the economy (Kuijs, 1998). The increase in salary of workers in 1975 further enhanced the purchasing power of the individuals. Oil revenue increase significantly and by 1980, Nigeria was rated one of the middle income countries. Despite this fit inflation, deficit finance, balance of payment disequilibrium and corruption have appeared on the scene as a case of concern.

Most significant of these macroeconomic factors is inflation as an epicenter due to its general effects on prices of goods and service and growing ability to relegate economy. In the 1980s, oil production fell and the production quota also decline leading to fall in oil price and revenue. The country had to resort to borrowing in order to

meet its financial obligations. Also, the lackluster performance of the economy and inadequate tax programs frustrated government efforts at generating enough revenue for expenditure, hence the pursuance of the policy that finance government expenditure by creation of money becomes inevitable (Onwioduokit, 2002). More recently, the financial tsunami and drought that hit most part of the world has created a supply crisis, aggravating the upward trend in food prices (Durmus, 2008). Nigeria is an import dependent nation. The growing gap between domestic demand and domestic production was filled by a sharp increase in net imports. With the attendant slow growth rate in developed economies, looming financial crises and increasing tariffs, it became obvious that the Nigeria nation have imported inflation courtesy of the high marginal propensity to import.

This study is an attempt to identify the long run equilibrium, causal relationship between inflation and its determinants, and to ascertain the policy frame work within which inflation can be reduced. More so the study shall investigate the response of inflation to its own innovative shocks and other determinants innovative shocks in Nigeria between 1986 and 2011. The first section of the paper is introduction. The second section is the theoretical framework and literature review, whereas, section three presents the methodology of the study. The fourth section of the paper dwells on presentation and analysis of estimated results, and section five is conclusion and recommendations of the study.

2. Literature Review

2.1 Theoretical Considerations and Empirical Evidence

Inflation can be defined as a sustained and continuous rise in the general price level of goods and services. Alternatively, inflation is a sustained and continuous fall in the value of money. Generally, some theories have been identified with respect to the concept of inflation. The demand-pull paradigm is of the view that inflation exist when aggregate demand for goods and services exceed aggregate supply for goods and services, such that the excess aggregate demand cannot be satisfied by running down the existing stocks, diverting supplies from the export market to the domestic market, increasing imports or postponed demand. In the cost-push theory, prices rise via increase cost of production. This theory maintained that prices of goods and services rise because wages are pushed up by trade unions' bargaining power, or by the pricing policies of oligopolistic and monopolistic firms with market power. The cost-push view attributed inflation to a host of non-monetary supply-oriented influences of shocks that raise costs and consequently price. In recent time, this school of thought attributed inflation to such random non-monetary shocks such as crop failures, commodity shortages, vagaries of weather and increase in the price of oil (Onwioduokit, 2002). Chibber and Shafik (1990) argued that "wage push inflation is rare in Africa", largely because wages constitute only a small part of national income. However, this might not be true of Nigeria as any rise in wage simultaneously triggers upward prices of goods and services. The structuralists explained the long-run inflationary trends in developing countries in terms of structural rigidities, market imperfection and social tension, relative inelasticity of food supply, foreign exchange constraints protective measures, rise in demand for food, fall in export earnings and political instabilities. Unarguably, monetarists opined that "inflation is always and everywhere a monetary phenomenon resulting from and accompanied by a rise in the quantity of money relative to output", hence prices tend to rise when the rate of inflation in money supply is greater than the rate of increase in real output of goods and services. On the contrary, imported inflation arises from international trade where inflation is transmitted from one country to another, particularly, during periods of rising price all over the world (Anyanwu, 1992). These paradigms supports some of the reasons why inflation rate in Nigeria is high, but, the monetarists view gained prominence. In this regard an empirical investigation of the determinants of inflation is essential. The high inflation rate has become a major concern because poverty rate has increased (Olatunji, Omotesho, Ayinde and Ayinde, 2010).

2.2 Empirical Evidence

This study identify some empirical studies on the determinants of inflation. Gaomab (1988) used an unrestricted autoregressive distributed lag (ARDL) model to show clearly the difference between short run and long run price relationship. The result revealed that changes in Namibian broad money on goods and services (consumption) supply was a significant determinant of inflation. Canetti and Greene (1991) measured the influence of monetary growth and exchange rate changes on prevailing and predicted rates of inflation. The study area includes: the Gambia, Ghana, Kenya, Nigeria, Sierra-Leone, Somalia, Tanzania, Uganda, Zaire, and Zambia. The adopted tool of analysis was the Vector autoregression technique. The findings of the study indicates that monetary dynamics dominate inflation levels in four countries, but in three other countries, exchange rate depreciations regulates inflation. In a study on the monetary transmission mechanisms and inflation in the Slovak Republic, Kuijs, (2002) estimated the long-run cointegrating relationship for goods, labour, money and foreign exchange markets. It was found that inflation was significantly influenced through foreign prices, exchange rate and wages, but insignificantly through the aggregate demand.

Metwally and Al-Sowaidi (2004) employed a simultaneous equation to explain the nature and causes of inflation in Egypt between the period 1986 – 2002. Three separate equations were identified. The outcome of the three estimated models indicated that both demand pull and cost push factors determined inflation in Egypt. Furthermore, the study revealed that the rate of price change is more elastic with respect to the rates of change in fiscal and monetary policies than changes in import prices. Leheyda (2005) investigated the determinants of inflation in Ukraine, the study apply cointegration analysis and error-correction model. The analysis was based upon three hypothesis of inflation determination: excess money supply, foreign inflation and cost-push inflation. The result of long-run Johansen cointegration established that the long-run money demand, purchasing power parity and mark-up relationships increase prices in the long run. In the short-run inflation inertia, money supply, wages, exchange rate and real output as well as some exogenous shocks influence inflation dynamics.

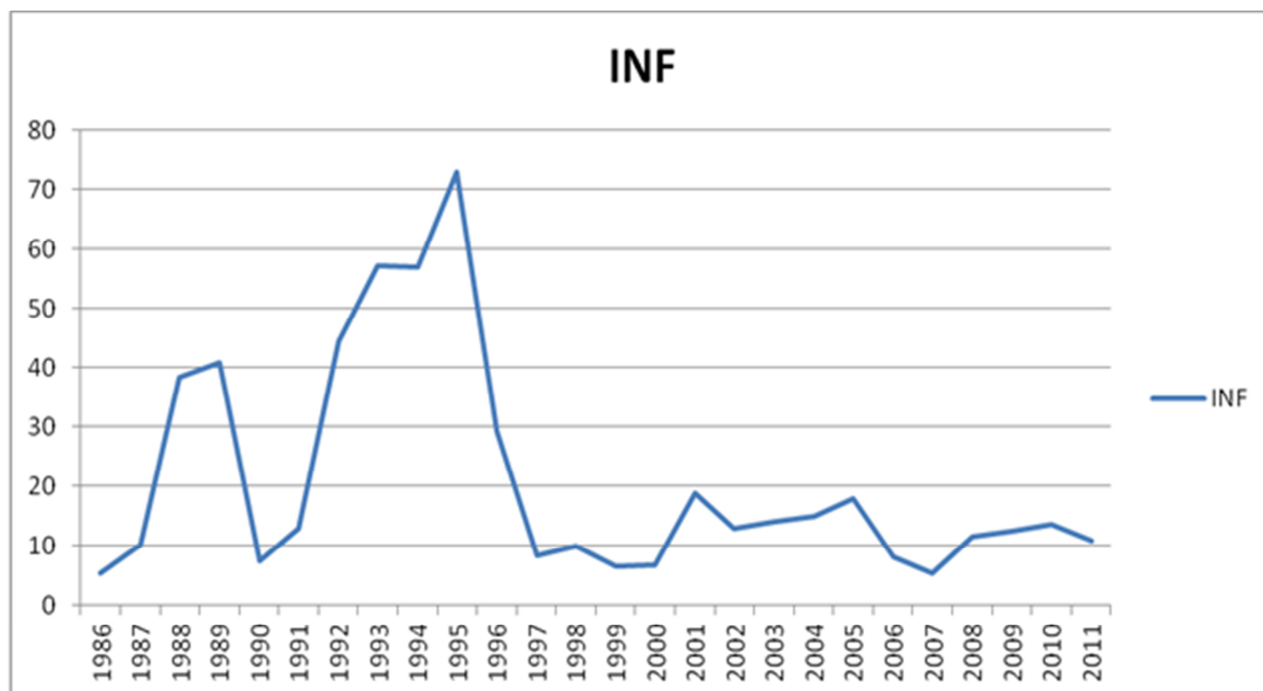
Mame (2007) investigated how consumer price inflation was determined in Mali between 1979 – 2006. The analysis made use of cointegration techniques and general-to-specific model. Average national rainfall, and to a lesser extent deviation from monetary and external sector equilibrium were found to be the main long-run determinants of inflation. In Nigeria, Busari (2007) used, among other measures, the Hodrick and Prescott filter. After decomposing inflation into trends of cyclical, seasonal, and, random components, the paper adopted the general to-specific modeling approach to investigate the main determinants of each component of inflation. The results confirmed that in the long run, inflation is largely and positively related to the level of (narrow) money supply and, marginally, to fiscal deficit. In the medium term, inflation was observed to be positively related to exchange rate depreciation and the growth of money supply. In the short run, it was observed that inflation was positively related to growth in money supply and exchange rate depreciation while it was negatively related to growth in real GDP.

Iyabode (1999) developed a two stage least square model to estimate inflationary trend in Nigeria during the period 1971 – 1995. The study employed a partial equilibrium model based on micro foundations to solve price level. The results confirmed the importance of parallel market exchange rate dynamics. Gary (1994) used an error correction model to determine the factors that affect inflation in Nigeria. The result indicates that monetary expansion, driven mainly by fiscal policies, explains to a large degree the inflationary process in Nigeria. Fakiyesi (1996) studied inflation in Nigeria using auto regressive distributed lag (ARDL) model. He found that inflation is dependent on the growth of broad money, exchange rate of the naira vis-à-vis the dollar, the growth of real income, the level of rainfall, and the level of anticipated inflation, which was based on the previous year's level of inflation. Odusola and Akinlo (2001) employed unrestricted VAR technique and impulse response to examine a study on output, inflation and exchange rate in Nigeria. Evidence from impulse response functions and structural VAR models showed a negative influence of inflation on the output. But output and parallel exchange rate were found to be the major determinants of inflation dynamics in Nigeria.

Imimole and Enoma (2011) conducted a research on the impact of exchange rate depreciation on inflation in Nigeria. Using auto regression distributed lag (ARDL) and cointegration procedures. Evidence from the estimate results suggests that exchange rate depreciation, money supply and real gross domestic product were the main determinants of inflation in Nigeria. Odusanya and Atanda (2010) critically examined the dynamic and simultaneous inter-relationship between inflation and its determinants in Nigeria within the period 1970 – 2007. The Augmented Engle-Granger (AEG), cointegration test and error correction model were employed. The estimated result indicates substantial benefits accrued when moving from high or moderate rate to low level of inflation.

Bakare (2011) examined the determinants of money supply growth and its implications on inflation in Nigeria. The study employed quasi-experimental research design approach for the data analysis. The design combined theoretical consideration (a priori criteria) with empirical observations and extracted maximum information from the available data. The estimated regression result revealed a positive relationship between money supply growth and inflation in Nigeria.

Figure 1: Trend of Inflation Rates in Nigeria between 1986 and 2011.



Source: Computed by the authors from Microsoft excel 2014.

2.3 The trend of Inflation Rates in Nigeria.

The diagram in figure 1 above showed the trend of inflation in Nigeria between 1986 and 2011. In 1986, inflation rate was 5.4 per cent. This rate was the least of inflation rate that ever occurred in Nigeria within the period under review. Since then inflation rate increased sharply from 10.2 per cent in 1987 to 40.9 per cent in 1989. This behaviour was the result of the adverse effect of the depreciation of naira currency against other international currencies following the emergence of structural adjustment programme (SAP) in 1986. The inflationary trend indicates that inflation rate dropped significantly to 7.5 per cent in 1990 but rose sharply to 57.2 per cent in 1993 and sustained this momentum to its highest peak of 72.8 per cent in 1995. Again, it was the depreciated naira currency in relation to the dollar and the increase cost of production reflected in high prices of food stuff as well as changing prices of imported goods that triggered up the inflation rate to a highest peak of 72.8 per cent in 1995. From 1996, inflation rate dropped significantly to 29.3 per cent from 72.8 per cent in 1995 and this downward trend was sustained continuously, although with some level of oscillation but not below the minimum rate of 5.4 per cent in 2007. Between 2008 and 2011, inflation rate increased slowly but steadily from 11.6 per cent in 2008 to 13.7 per cent in 2010 but decreased to 10.9 per cent in 2011. The inflationary trend of Nigeria, as depicted by figure 1 above, simply suggests the macroeconomic instability of inflation rate, with an attendant consequence of low level of investment, sluggish economic growth rate and high poverty rate. Besides, the macroeconomic instability of inflation rate has widened the gap between the high income class and low income earners in Nigeria. Certainly, the trend analysis supports various sources and theories of inflation as the reason for the behaviour in Nigeria.

3 Methodology: Source of Data, Data Analysis and Models Specification

The study made use of time series data from 1986 – 2011 obtained from Central Bank Nigeria (CBN) statistical bulletin volume 22. Macroeconomic forecasting model have traditionally been formulated as simultaneous equation structural models. However, for a variety of reasons – such as the inexact manner in which certain variables are excluded from the model's equations and the need to include future values of exogenous variables – structural models have proved unreliable for forecasting (Busari, 2007). The vector autoregressive (VAR) model is one of the most successful, flexible, and easy to use model for the analysis of multivariate time series. The VAR model has proven to be useful for describing the dynamic behaviour of economic and financial time series for policy making. Vector autoregressive (VAR) model offers alternative structural macroeconomic model for forecasting purposes. In contrast to simultaneous structural model, a VAR model is a set of dynamic linear equations in which each variable is determined by every other variable in the model. Doan, Litterman and Sims (1984), and Busari (2007) have used VAR model to explain the behaviour of inflation. Therefore, this study adopt a VAR model to determine the variables that influence inflation in Nigeria within the sample period of

1986 – 2011. VAR models provide information on impulse responses (Adrangi and Allender, 1998). Palm (1983) proposed that any linear structural model can be written as a VAR model. The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis Johansen (1991 and 1995). Most time series data are non-stationary and using non-stationary variables in the model might lead to spuriousness of regression results (Granger, 1969). Because of this, all the variables are tested using Augmented Dickey-Fuller (ADF) unit root statistics test. The ADF statistic test is conducted using equation (1) which includes constant and time trends. The equation is expressed as:

$$\Delta Y_t = \alpha + \gamma t + \Phi Y_{t-1} + \sum_{i=1}^k \Delta Y_{t-i} + U_t \dots\dots\dots 1$$

Where ΔY_t is the first difference of the series Y, k is the lag order, t is the time

3.1 Ordinary Least Square (OLS) and Cointegration Procedure

The cointegration test was used to determine the long-run relationship of the variables in the model. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. The purpose of the cointegration test is to determine whether a group of non-stationary series are cointegrated or not. As explained below, the presence of a cointegrating relation forms the basis of the VEC specification (EViews 5 software). The Johansen co-integration was used because it performs better in multivariate model. The estimation procedure requires the need to identify an ordinary least square (OLS) process. The deterministic form of OLS model is given as:

$$ROI = F(RGDP, EX, LR, FD, ARGDP, MS, MP) \dots\dots\dots 2$$

The multivariate stochastic form of equation 3 is of the form:

$$ROI = \beta_0 + \beta_1 RGDP_t + \beta_2 EX_t + \beta_3 LR_t + \beta_4 FD_t + \beta_5 ARGDP_t + \beta_6 MS_t + \beta_7 MP_t + u_t \dots\dots 3$$

Econometric views implements VAR-based cointegration tests using the methodology developed in Johansen (1991). The estimation procedure for equation 4 assumed a vector autoregressive (VAR) base cointegration test (Johansen 1991) of order p which is given as

$$Y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + Bx_t + e_t \dots\dots\dots 4$$

Where y_t is a k - vector of non-stationary I(1) variables, x_t is a d -vector of deterministic variables, and e_t is a vector of innovations. This VAR model through which a cointegration estimate is determined is given as follow

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + e_t \dots\dots\dots 5$$

Where

$$\Pi = \sum_{i=1}^p A_i - I \quad \text{and} \quad \Gamma_i = \sum_{j=i+1}^p A_j \dots\dots\dots 6$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta'y_t$ is I(0). r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π .

3.2 Expectations of the Variables in the Model

Inflation rate (ROI) is the dependent variable for this study. Variables like real gross domestic product (RGDP), lending rate (LR), GDP of Agriculture (ARGDP), money supply (MS), import (MP), fiscal deficit (FD) and exchange rate (EX) are the independent variables. ROI is expected to have direct relationship with GDP, EX and LR but MS and MP are expected to have an indirect relationship with ROI. U represents error term which stands for the omitted factors that affect inflation but were not captured in the model. Subscript t indicates that the data for this study is time series data. It is expected that as GDP of the economy improves inflation decreases. Theories hold that increase in money supply and import price will increase inflation rate. The unbridle exchange rate will increase inflation rate when the Nigerian Naira currency depreciates against international currencies. The variables in the model revealed that inflation is a product of domestic and external factors.

3.3 The Vector Autoregressive (VAR) Model

Considering two economic time series Y_{1t} and Y_{2t} which represents the relationship between inflation and its determinants. The VAR model with only one lag in each variable is shown by equation 11:

$$Y_{1t} = a_{11}Y_{1, t-1} + a_{12}Y_{2, t-1} + e_{1t} \dots\dots\dots 11$$

To rewrite equation 11 in order to accommodate more than one endogenous variable and one lag, that is the case with k endogenous variables and p lags, the VAR model is given in equation 12 below:

$$Y_t = \sum_{i=1}^m A_i Y_{t-i} + \dots + \sum A_p Y_{t-p} + e_t \dots\dots\dots 12$$

Where:

Y_t and its lag values, and e_t are $k \times 1$ - vectors of endogenous variables and $A_1 \dots A_p$ are $k \times k$ - matrices of constant to be estimated or vector of explanatory variables. The VAR result shall enable us to analyze the impulse response functions and forecast variance decompositions. The impulse response tells us how inflation variable respond to shocks in the policy variables, while the variance decompositions show the magnitude of the variations in the inflation due to the policy variables.

3.4 The Granger Causality model

This study also provides a causality test to determine the causal relationship between inflation and its determinants. In his view, Granger (1969) Y is said to “Granger-cause” X when only X is better predicted by using the past values of Y than by not doing so with the past values of X being used in either case. In this study, where only the lagged value of the inflation variable in equation 13 is significant, it infer that inflation Granger causes (inflation determinants) RGDP, EX, LR, FD, ARGDP, MS and MP. If the lagged independent variables in the two equations are significant, then, it inferred a bi-directional causality between inflation and its determinants, but where only the lagged value of the determinants of inflation equation 14 is significant, it suggests that the determinants Granger causes inflation. To determine whether there is Granger causality between inflation and its determinants. The Granger causality model was adopted in line with Engle and Granger (1987), Adeolu (2007), Khan, (2007) and Egbo (2010) with some remarkable modification in the interest of this study.

$$ROI_t = M_1 + \sum yiROI_{t-1} + \sum \beta_1 DTF_{t-1} + \sum \epsilon_{1t} \dots\dots\dots 13$$

$$DTF_t = M_2 + \sum \beta_1 DTF_{t-1} + \sum yiROI_{t-1} + \sum \epsilon_{2t} \dots\dots\dots 14$$

Where

M_1 and M_2 are constants, and Σ_{1t} and Σ_{2t} are the stochastic term. ROI is the rate of inflation whereas DTF represents the various inflation rate determinants RGDP, EX, LR, FD, ARGDP, MS and MP.

The statement of hypothesis is

H_{01} : ROI does not Granger cause DTF

H_{02} : DTF does not Granger cause ROI

4. Presentation of Estimated Results and Discussion

4.1 Augmented Dickey Fuller (ADF) test statistics.

The variables that were tested are those specified and defined in the model of this study. These are ROI, RGDP, LR, FD, EX, MP, ARGDP and MS. This study present the results of Augmented Dickey-Fuller unit root statistic test in Table 4.1 below. The variables where non stationery at the level, but after first and second difference at 1%, 5% and 10% level, all the variables became stationary indicating the absence of a spurious and misleading interpretation of regression line. The variable MS become stationary after subjecting it to the 4th lag, while others became stationary after 2nd lag. Also, the unit root test was conducted with the consideration of trends and intercepts.

Table 4.1: Augmented Dickey Fuller (ADF) test statistics.

Variables	Order of Integration	Critical value	Computed ADF value @ 95%
ROI	I(1)	-4.4691 -3.6454 -3.2602	-5.393235
RGDP	I(2)	-4.5000 -3.6591 -3.2677	-4.981684
LR	I(1)	4.4691 -3.6454 -3.2602	-6.980583
MP	I(1)	4.4691 -3.6454 -3.2602	-6.042079
ARGDP	I(2)	-4.5000 -3.6591 -3.2677	-6.971229
MS	I(1)	-4.5348 -3.6746 -3.2762	-6.066620
EX	I(1)	-4.4691 -3.6454 -3.2602	-8.045086
FD	I(1)	4.4691 -3.6454 -3.2602	-5.002066

Source: Computed from econometric views 7 software by the authors (2014).

Note: Critical value at 1%, 5% and 10% respectively

If $t^* \geq$ ADF (Critical value) unit root exist

If $t^* \leq$ ADF (Critical value) unit root does not exist.

Table 4.2: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace statistics	0.05 Critical value	Probability**
None *	0.998047	657.2926	159.5297	0.0000
At most1*	0.989380	426.4702	125.6154	0.0001
At most2*	0.898961	258.3050	95.95366	0.0000
At most3*	0.857324	173.4917	69.81889	0.0000
At most4*	0.761305	101.4460	47.85613	0.0000
At most5*	0.580420	48.44104	29.79707	0.0001
At most6*	0.233622	16.30646	15.49471	0.0377
At most7*	0.160237	6.461510	3.841466	0.0110

Trace statistics test indicates 8 cointegrating equations at 0.05 level.

*denotes rejection of the hypothesis at 0.05 level

**McKinnon – Haug- Michilis (1999) p-values

Source: Computed from econometric views 7 software by the authors (2014).

Table 4.3: Unrestricted Cointegration Rank Test (Maximum Eigenvalue).

Hypothesized No. of CE(s)	Eigen value	Max-Eigen statistics	0.05 Critical value	Probability**
None *	0.998047	230.8224	52.36261	0.0001
At most1*	0.989380	168.1652	46.23142	0.0000
At most2*	0.898961	84.81326	40.07757	0.0000
At most3*	0.857324	72.04573	33.87687	0.0000
At most4*	0.761305	53.00497	27.58434	0.0000
At most5*	0.580420	32.13458	21.13162	0.0010
At most6*	0.233622	9.844946	14.26460	0.2223
At most7*	0.160237	6.461510	3.841466	0.0110

Maximum rejection test indicates 8 cointegrating equations at 0.05 level.

*denotes rejection of the hypothesis at 0.05 level

**McKinnon – Haug- Michilis (1999) p-values

Source: Computed from econometric views 7 software by the authors (2014).

4.2 Analysis of Johansen co-integration test result.

Table 4.2 above showed the result of Johansen co-integration test of two likelihood ratio test statistics: the Trace statistic and the Maximum Eigenvalue are commonly used to determine the number of co-integrating vectors in a study. The Johansen co-integration test reveals that there are at least eight cointegrating vectors in the series which was evident of the presence of a long-run equilibrium relationship between the variable inflation rate and its explanatory variables. Linear deterministic trend was assumed in the test. It is confirmed from the Maximum –Eigen statistic test in Table 4.3 above that the null hypothesis is rejected at 5 percent level.

Table 4.4: Pairwise Granger Causality Tests

Null Hypothesis	Observation	F - Statistics	Probability	Remark
EX does not granger cause ROI	39	0.28322	0.7552	A
ROI does not granger cause EX		0.21660	0.8064	A
FD does not granger cause ROI	39	0.06914	0.9333	A
ROI does not granger cause FD		0.94787	0.3982	A
RGDP does not granger cause ROI	39	0.53439	0.5912	A
ROI does not granger cause RGDP		0.08442	0.9192	A
LR does not granger cause ROI	30	3.02547	0.0626	R
ROI does not granger cause LR		1.77962	0.1850	R
MP does not granger cause ROI	39	0.54695	0.5840	A
ROI does not granger cause MP		0.02446	0.9940	A
MS does not granger cause ROI	39	0.53909	0.5885	A
ROI does not granger cause MS		0.00605	0.9940	A
GDPAG does not granger cause ROI	39	0.27637	0.7603	A
ROI does not granger cause GDPAG		0.17996	0.8361	A

Note: A = Accepted, R= Rejection

Source: Computed from econometric views 7 by the authors (2014).

4.3 Interpretation of Granger causality test result.

Table 4.4 presents the estimated results of Granger causality test. The maximum lag is 2, which was obtained, following Akaike information criterion (AIC). The lag length was considered appropriate in order to avoid the problem of spuriousness of regression at 5 percent level of significance. The Pairwise Granger causality results revealed a bidirectional causality relationship between inflation and exchange rate, fiscal deficits, gross domestic product, imports, money supply and agriculture output. This simply suggests that the Granger causality test is evidence of a feedback relationship between inflation and its determinants. But lending rate had a unidirectional causality running from lending rate to inflation rate. Therefore, the null hypothesis for this result is rejected.

4.4. Analysis of the Vector autoregressive (VAR) result.

The result of the VAR model was not presented because of space. The result of the VAR model provides useful and reliable information about the response of a variable to innovations in another. The estimated VAR result showed a negative relationship between the rate of inflation (ROI) and fiscal deficit (FD), exchange rate (EX), lending rate (LR), import (MP) and money supply (MS) in the short run but a positive relationship in the long run, however, only LR was statistically significant at 5 per cent level. This outcome clearly demonstrates useful

information about the response of a variable to innovations in another. The outcome of the estimated result was expected. For instance, inflation in the short run was expected to reduce the performance of the economy – RGDP but in the long run when producers must have adjusted to the shock, the performance of the economy will improve. This tally’s with the classical traditional theory. Also, fiscal deficit might trigger inflation to rise especially in the period of unemployment in the long run (Keynesian theory) and prices of imported goods to rise in the long run because of continuous high demand. Financing government expenditure by the creation of money has becomes inevitable (Onwioduokit, 2002), thus, the volume of money supply has continued to rise accounting for the long run increase in inflation rate in Nigeria, a situation that relates to the monetarists’ theory of inflation. The VAR model estimate demonstrates the volatile exchange rate (EX) ability to increase inflation in the long run. This result confirmed the increased depreciation of the value of the Naira currency in exchange against other foreign currencies.

4.5 Variance Decomposition (VD) Analysis.

Owing to large space which this result occupies, a summary of the result on Variance Decomposition (VD) is presented in the table 4.6 below. Own shock of inflation rate ranged from 100 percent to 17 percent. The exchange rate own shock constitute the predominant source of variation in the inflation rate. The variation ranged from 99.53 percent to 34.34 percent over the ten-year horizon. More importantly, the volatility or unstable behaviour of exchange rate was observed in this result. Fiscal deficit own shock within the study period oscillated between 87.96 and 8.35 percent over the ten years period. The striking feature of VD results is that exchange rate, fiscal deficit and agricultural output are the predominant sources of inflation rate own shock. In essence, this result suggests that innovation in inflation is better forecasted by foreign exchange, fiscal deficits, gross domestic product and agricultural output. This outcome is expected in this study. However, the variance decomposition result for import and money supply range from 11.31 to 4.71 and 8.02 to 0.85 respectively, indicating that innovation in inflation is less explained by import and monetary influence in Nigeria.

Table 4.6: Variance Decomposition Result.

RESPO NSE PERIO D	Summary Of Variance Decomposition Result								
	S.E.	ROI	EX	FD	RGDP	LR	MP	MS	GDPAG
1	12.3250 4	100.000 0	99.5343 8	87.9577 5	71.9403 6	54.7031 9	11.31065	8.015573	70.51949
2	13.3566 7	96.7325 2	85.4332 9	35.8958 5	33.0760 3	40.2899 6	9.776546	2.122172	62.31452
3	18.1558 8	7 7.42873	68.4610 7	8.81243	23.0600 6	29.5448 7	3.798697	1.059541	39.76065
4	24.0759 3	49.1145 9	72.3817 1	2.28650 4	21.7125 0	24.1322 5	2.562619	0.513424	16.37412
5	35.2828 1	42.7174 9	50.4223 8	2.65890 4	32.0371 2	22.9642 8	9.415807	0.414485	14.14440
6	22.0418 4	29.5451 9	40.0034 1	2.63808 4	42.3705 7	12.1749 9	7.242162	0.382819	13.04163
7	42.2029 7	21.2417 5	44.9360 8	4.50980 4	48.3396 0	10.2192 9	4.204045	0.693118	5.613991

8	43.2906 3	23.3652 2	38.1052 8	22.2146 6	38.6496 0	8.00043 3	8.772545	1.052582	7.175792
9	66.5077 4	12.8086 2	34.3442 4	17.5375 3	45.5261 2	5.01644 1	4.339351	1.491487	4.130344
10	73.7741 2	17.4347 7	45.5725 2	8.35143 9	25.2328 5	4.44605 7	4.714794	0.849534	1.802576

Cholesky Ordering: ROI EX FD RGDP LR MP MS GDPAG

Source: Computed from econometric views 7 software by the authors (2014).

4.6 Impulse Response Analysis

Table 4.7 below shows the impulse response pattern of economic growth to a stimulated one percent permanent increase in itself and in every other endogenous variable. The result reveals that ROI own innovative shock is 12.33% in the first period but became negative from third period and continued to decrease to -19.55% in the tenth period. The exchange rate innovation shock in inflation indicates that the long term horizon is a concentration of negative influence on inflation. This confirms the unstable pattern of exchange rate in Nigeria. Similarly, fiscal deficit sustained a negative long run influence on inflation. However, real gross domestic product and gross domestic production in agriculture consistently sustained positive influence on inflation. The lending rate innovation shock was 3.04% on inflation in the first period but dies out gradually to 0.16% in the tenth period or long term horizon. Money supply and imports have positive relationship with inflation throughout short and long run periods. The pattern of relationship in this study was expected. Generally, the result indicates that all the variables used in this study influenced inflation in Nigeria.

TABLE 4.8: IMPULSE RESPONSE RESULT

RESPONSE PERIOD	SUMMARY OF IMPULSE RESPONSE RESULT							
	ROI	EX	FD	RGDP	LR	MP	MS	ARGDP
1	12.32504 (1.43276)	28.08730 (3.26508)	29367.98 (3413.96)	180157.4 (20942.9)	3.035103 (0.35282)	95077.95 (11052.6)	5883.900 (683.990)	6110.287 (710.306)
2	4.545867 (2.45087)	- (9.44997)	- (4883.95)	198053.2 (46925.3)	1.113924 (0.66798)	60122.97 (36749.3)	7461.344 (1265.93)	5045.066 (1633.25)
3	- (3.36325)	4.090742 (22.7775)	24.24092 (9483.99)	5581.747 (90472.8)	126507.7 (0.66789)	1.463868 (39626.5)	2754.621 (3691.86)	18037.14 (1993.55)
4	- (5.91186)	7.022383 (101.902)	96.45028 (14801.3)	11024.33 (112723.)	142847.6 (1.28171)	1.231846 (90085.9)	86133.61 (13343.5)	3028.122 (2742.56)
5	- (6.58197)	2.998766 (163.33)	76.77888 (33098.3)	18721.76 (145731.)	375347.9 (1.39656)	0.271146 (237529.)	293585.7 (20854.8)	13676.18 (4708.88)
	-	-	-	637629.4	-	-	-	-

6	10.96307 (11.2557)	81.71558 (245.235)	13918.36 (37717.3)	(178669.)	0.385625 (1.66744)	122841.9 (265179.)	16156.61 (54460.6)	1380.641 (4785.03)
7	3.245559 (15.9210)	204.9769 (500.707)	76035.40 (82648.3)	1024520. (542319.)	0.690314 (2.39801)	324215.4 (273579.)	36523.71 (47923.2)	2402.963 (4710.82)
8	- 7.716730 (23.4049)	- 137.1007 (707.304)	- 227610.1 (106730.)	655532.1 (643152.)	0.454203 (2.54500)	608430.4 (672276.)	53367.18 (79268.0)	6038.901 (11118.1)
9	11.34365 (41.7905)	82.78368 (1110.20)	62679.55 (125059.)	2057037. (937814.)	0.861542 (3.07703)	33989.80 (677858.)	129794.4 (132854.)	533.9239 (10148.1)
10	- 19.55370 (59.9508)	- 339.5819 (1800.51)	- 144221.9 (411371)	1632061. (1221350)	0.613922 (9.19944)	- 422628.4 (767492)	- 106234.2 (182797)	- 6980.459 (14143.5)

Cholesky Ordering:

ROI E FD RGDP LR MP MS ARGDP. Computed from econometric views 7 software by the authors (2014).

5. Conclusion and Recommendations

This study investigated the main determinants of inflation in Nigeria between 1986 – 2011. The sluggish growth rate of the Nigerian economy hinge on macroeconomic instability variables, in particular, the high rate of inflation. Inflation rate erodes the gains from economic activity and worst off the divide between the rich and poor. This study developed a co-integration and vector auto regressive (VAR) model to explain the factors that influence inflation in Nigeria. The outcome from the estimated parameters indicated robustness of results. The results of Johansen Co-integration test satisfy the presence of long-run equilibrium relationship between inflation and its explanatory variables. Granger causality test indicates the presence of a feedback or bidirectional relationship between inflation and its determinants, but causality run from lending rate to inflation. The estimated VAR model provided useful and reliable information about the response of a variable to innovation in another. Own shock of inflation decreased steadily. Exchange rate, Fiscal deficit and agriculture output are the predominant source of inflation rate own shock. In essence, this result suggests that innovation in inflation is better predicted by foreign exchange rate, fiscal deficits, and agricultural output. Generally, fiscal policy variables showed more robustness than monetary policy variables. The study recommends the need to check the persistent fiscal deficit in order to reduce over-spending and the series of government agricultural policies should target small and medium agricultural firms for improve production, this will strengthen or appreciate the naira exchange rate against other currency.

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