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Other Determinants of Inflation in Nigeria

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Abstract
Inflation is a continuous macroeconomic concern that has dominated thoughts at major economic fora due to its pervasive effect on the economy. The quantity theory of money isolates money supply as the major cause of inflation. The economic reality in Nigeria contravenes the theory. The study examines other determinants of inflation in Nigeria using the autoregressive distributed lag (ARDL) method on quarterly data from January 1999- December 2018. Findings show that poor infrastructural development, exchange rate, political instability, corruption, and double taxation significantly stimulate inflation rather than just money supply. The results show a causal relationship between other determining factors and inflation. The ARDL result shows a significant long-short run relationship. The study recommends that non-monetary factors of instigating inflation should be controlled and security expenditure should be review along with-related mechanisms to achieve low inflation at single digits at most and economic growth and development.

Keywords: inflation rate, money supply, Nigeria, economic indicators, ARDL Error Correction Model

1. Introduction

The prime objectives of the 21st-century economic system are the stability of prices of products and services at an inflation rate that is not detrimental to the economic, business and financial climate (Ben, Udo, Abner, Ike, Tingir & Ibekwe, 2018). According to Abdul, Syed, and Qazi, (2007) as cited in Anfofum, Afang and Moses, (2015) single-digit inflation rate of 2-6 percent has a positive and significant impact on the economy through increased wages, consumption, investment, creativity, invention, and production. Double-digit inflation has a calamitous micro and macroeconomic consequences that erode consumers' purchasing power and diminish indicators of economic growth and development. The destructive impact of inflation in developed and emerging economies particularly in Nigeria from the 1970s has occupied public discussion and is of prime concern to all stakeholders. Economists unanimously define inflation as a general, continuous and persistent increase in the general price level of products and services within an economy. According to Okoye, Olokoyo, Ezeji, Okoh, and Evbuomwan, (2019) inflation is a general, continuous and persistent increase and not a distinctive increase in the general price of products and services. The definition bares the prerequisites of "*general, continuous and persistent*" for price increase in products and services to qualified as inflationary. High inflation diminishes indicators of economic growth and development globally.
The highest average rate of inflation was recorded in the 1980s and 1990s at 15% and 16% respectively. Developed economies in the 1970s recorded a single digit at 9% and developing economies at 37% on average (Al-Shammari and Al-Sabaey, 2012).

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Determining factors of inflation vary according to stages of economic, financial and business development and growth.

The quantity theory of Money proposed by monetarists distinguishes money supply as the prime cause of inflation. According to monetarists' increase in money supply (M_1, M_2, and M_3) increases inflation. The price level of products and services consumed within an economy is directly proportional to the volume of money supply in circulation. Friedman (1963) opine that inflation is continuously a monetary phenomenon; a unit increase in money supply induces inflation than in output. Bashir, Nawaz, Yasin, Khursheed, Khan, and Qureshi (2011) and Kabundi, (2012) among others corroborate the monetarist proposition of a linkage between money supply and general price level.

Money supply impacts on consumer pricing behaviour and is absolutely a substantial variable and also a critical channel of monetary policy transmission. Fisher 's exchange equation of (MV = PT) is adopted to regulate the link between money supply and price level.

MV = PT

Where: M = Currency and other financial instruments in circulation (M_0, M_1, M_2, M_3).

V = Velocity of money (measured by the rate of money exchange hands within an economy).

P = Prevailing Price level.

T = Output level (goods and services produced within an economy).

Fisher 's equation revealed that the (MV) symbolizes money supply and (PT) demand for money. The demand for money is dependent on financial transactions. In the short-term, (V) and (T) are assumed to be constant and exogenously determined while (P) varies significantly and equitably, with (M) without any impact on output level (T). The quantity theory of money recommends a decrease in money supply to condense inflation in a modest way and vice versa in the cases of disinflation and deflation (Udo, Ben, Abner, Okoh & Okolo 2019).

2. Criticism

The critics of this theory differ in both long and short-terms. In Nigeria, the assumption of a constant state of (V) and (T) is unrealistic due to the effect of non-economic factors of political instability, multiple taxation, poor social and economic infrastructural development, insecurity, corruption among others on the economy stimulating inflation rather than just money supply.

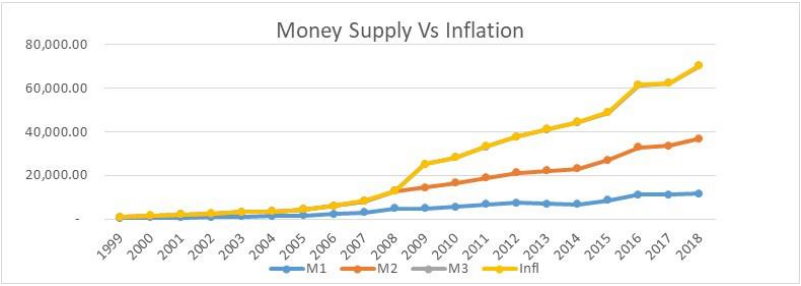

Figure (1) Money supply V s Inflation in Nigeria

Figure (1) above confirms the criticism of the quantity theory that money supply does not primarily instigate inflation but other determining factors of political instability, multiple taxation, poor social and economic infrastructural development, insecurity, corruption among others are contributive factors. Mordi et al (2007) and Masha (2000) cited in Bawa, Abdullahi, and Ibrahim (2016) tied the increase from single-digit inflation in the 1970s to double digits in 1990s at 72.8% to factors of climatic conditions, wages, production, currency devaluation along with fiscal factors of (budget deficits financing), balance of payments or supply-side factors of (exchange rate regimes) and institutional factors of (independence level of monetary authority). Others were structural factors, of agro-climatic conditions and inflation inertia replicating the structural characteristics of the Nigerian economy (Udo, Ben, Abner, Okoh & Okolo 2019).

According to Chibber and Shafik (1990) "wages push inflation is rare in Africa", in Africa there is a non-significant relationship between wages and its impact on economic growth. Wages constitute a trivial portion of national income. In Nigeria, the narrative differs as a unit increase in wage concurrently triggers skyward prices of products and services. Moser (1995) identifies fiscal and monetary policies in Nigeria as a major instigator of inflation. Kandil and Morsy (2011) in the oil-rich Gulf Cooperation Council (GCC) identify credit and aggregate oil expenditure as factors inducing inflation.

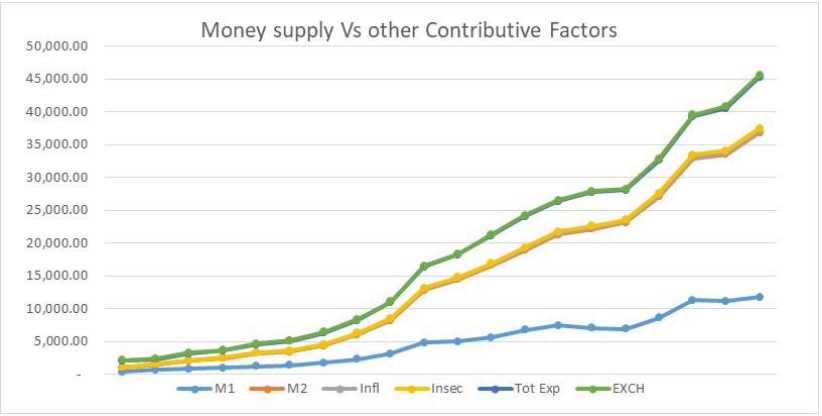

Figure (2) Money supply Vs Other Determining Factors
Sources: Authors Computation (2019)

Figure (2) above confirms the claims of Udo, Ben, Abner, Okoh, and Okolo (2019); Mordi et al (2007) and Masha (2000) on factors of social, economic, political and business instigating inflation other than money supply.

Diverse theories of inflation presented by economists revealed various channels inflation influences the economic climate. The Demand-Pull inflation theory raises where aggregate demand (AD) exceeds aggregate supply (AS) in any economy. A unit increase in production cost, land, labour, capital, entrepreneurship and overall price level lead to cost-push inflation. Structural inflation emanates from the disequilibria cause in the process of economic development through the structural changes.

Economists uphold that structural inflation in developing economies is associated with institutional and structural constraints. According to Campêlo and Cribari-Neto (2003),

inflation unveils the propensity of replicating itself from one period to another even in the absence of economic shocks (Bawa, Abdullahi & Ibrahim (2016). Inertial inflation occurs when prices of products and services increase as a result of past inflation, notwithstanding the lack of structural stimulant. Empirically Modebe and Ezeaku (2016); Okoye, Modebe, Erin, and Evbuomwan (2017); Adeleye, Osabuohien, Bowale, Matthew, and Oduntan (2018), Udo, Ben, Abner, Okoh, and Okolo (2019) Okoye, et al (2019) among others examined the effect of inflation in diverse aspects in developed and emerging economies and report diverse results. The diverse results reported by preceding scholars and policymakers in Nigeria are traceable to scope and period of studies, the methodology adopted, variables used, and the nature of data among other factors.
The core objective of this study is to examine other determining factors of inflation on a quarterly basis from 1999 after the transition of political and economic powers from the military to the civilian to 2018.

3. Theoretical Framework

Milton Friedman along with other economists and policymakers link inflation to monetary factors while other to production functions. The classical economists link changes in monetary demand and supply conditions to inflation, with a unit increase in money supply increases the aggregate price level. The monetary economists consider monetary policy a more compelling instrument of economic equilibrium than fiscal policy. Keynesian economists link inflation to demand factors of a surplus in aggregate demand (consumption + investment + government spending) over aggregate supply with a unit increase in wages and prices of products and services placing a demand on the monetary authorities to increase the money in circulation and support productivity.
Economists acknowledge lack of agricultural value chain effect, social and economic infrastructural development, foreign exchange, saving-investment gap, economic, political and social imbalances as influencers of inflation, the uneven response of output to investment, money supply and deficit finance (Okoye, Olokoyo, Ezeji, Okoh & Evbuomwan, 2019).

Table (1) Summary of Empirical Review

Author	Scope	Objective	Methodology	Findings
Bashir, Yousaf, and Aslam (2016)	Pakistan 1972 to 2014.	Determinants of inflation in Pakistan.	Autoregressive and distributed lag model (ARDL)	Government expenditure, imports, revenue, and external debt instigate inflation in Pakistan in the long-run.
Diermeier and Goecke (2016)	Euro Zone, countries	Investigate the money supply on inflation	Granger causality and correlation analysis in the VAR approach	There is no causality between monetary aggregates and inflation.
Udo, Ben, Abner, Okoh, and Okolo (2019)	Nigeria monthly data From January 2010 to December 2018	Examine the missing link between money supply and inflation	Johansen Co-integration, Granger causality and vector error correction	Political instability, corruption, double taxation, poor social, economic and financial infrastructural development instigate inflation other than money supply.
Amassoma, Keji, and Emma-Ebere, (2018)	Nigeria 1970 to 2016	Examine the money supply to inflation from	Co-integration and ECM approach	There is no causality between money supply and inflation and vice versa.

Author	Scope	Objective	Methodology	Findings
Okoye, Olokoyo, Ezeji, Okoh & Evbuomwan, (2019)	Nigeria 1981–2016.	Determinants of Behavior Of Inflation Rate	autoregressive distributed lag (ARDL)	External debt, exchange rate, fiscal deficits, and money supply causes inflation.
Amassoma, Keji, and Emma-Ebere, (2018)	Nigeria 1970 to 2016	Examine the money supply to inflation	Co-integration and ECM approach	There is no causality between money supply and inflation and vice versa. The lack of causality is traceable to the 2015-2017 recessions in Nigeria.

4. Methodology

This study adopts the ex-post facto research design on quarterly time-series data from the Central Bank of Nigeria (CBN) Statistical Bulletin from January 1999-December 2018.

4.1 Variables

1. **Implicit Price Deflator to GDP:** proxy inflation calculated as (GDP at current basic prices / GDP at the constant basic prices). The ratio accounts for inflation rate change effects on the general price level of products and services that make up the GDP.
2. **Money Supply:** M_1, M_2, and M_3. M3 includes (M_2, M_1, M_0) and liquid components of money supply that are not in circulation such as repurchase agreement. M_3 is the broadest measure of money supply in an economy. M2 embraced M_0 and M_1 along with saving deposits and certificates of deposit.
3. **Monetary Policy Rate (MPR):** The minimum rediscounted rate (MRR) proxy monetary policy and served as the CBN anchor rate for other interest rates in the money market and the economy, influencing the cost of funds and its direction in the economy.
4. Total government expenditure (capital and recurrent to stabilized the economy) proxy fiscal policy.
5. The nominal exchange rate between the naira and the dollar proxy partly as a monetary policy tool and partly to accrue foreign reserves on behalf of the government in foreign exchange open market operations.

4.2 The Model Expression

$INF_t = f(M_{3t}, M_{2t}, M_{1t}, MPR_t, GOVEX_t, EXCH_t, INSE_t)$ …….. (1)

$INF = \beta_o + \beta_1 M_{3t} + \beta_2 M_{2t} + \beta_3 M_{1t} + \beta_4 MPR_t, \beta_5 EXCH_t, + \beta_6 GOVEX_t + \beta_7 INSE_t + \mu$……(2)

For ease of interpretation, the dataset was log transform following the natural log model. Equation 2 is transformed into:

$INF = \beta_o + \beta_1 LogM_{3t} + \beta_2 LogM_{2t} + \beta_3 LogM_{1t} + \beta_4 MPR_t, \beta_5 EXCH_t, + \beta_6 LogGOVEX_t + \beta_7 LogINSE_t + \mu$……(3)

5. Data and Result Presentation

5.1 Pre-Test

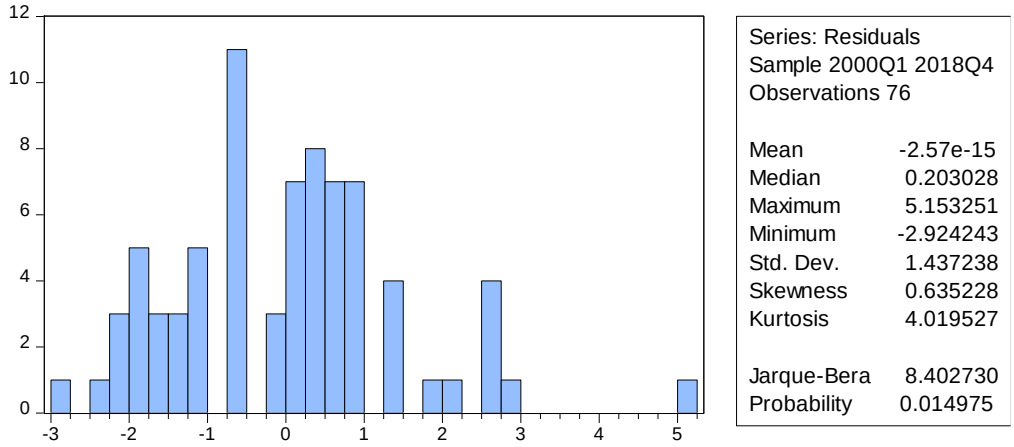

Figure-3. Descriptive Statistics

Figure 3: Displayed the aggregated averages of the mean, median and standard deviation a measure of spread and variation. Skewness, kurtosis, and Jarque-Bera measure the normality. The results are largely Leptokurtic and the kurtosis is < 3. The observations produce more outliers than the normal distribution.

5.2 Unit Root

The Augmented Dickey-Fuller (ADF) and Phillips and Perron, (PP) unit root tests were employed to determine the stationarity properties of the variables.

1. Null hypothesis: there is a unit root and the Alternative hypothesis: there is no unit root

The model expression: $\Delta yt\text{-}1 = \alpha 0 + \lambda y_{t-1} + \alpha 2_t + \Sigma p\ i=2\ \beta_j \Delta_{yt-1} + \mu_t$.

Y= dependent variable,

t= the trend,

a = intercept,

μ_t = white noise and p is the lag level.

Table 2 ADF and PP Unit Root Test Results

Variables	Test	At level @5%	Inference	Test	1st Difference @ 5%	Inference
INF	ADF	2.345(0.550)	Non-Stationary	ADF	-5.756(0.003)**	Stationary
	PP	-2.756 (0.218)		PP	-14.857(0.001)**	
LogGOVEX	ADF	-1.794(0.697)	Non-Stationary	ADF	-9.045 (0.001)**	Stationary
	PP	-2.277(0.440)		PP	-10.039(0.000)**	
$LogM_3$	ADF	-3.850(0.024)	Non-Stationary	ADF	-4.054(0.001)**	Stationary
	PP	-3.821(0.025)		PP	-15.190(0.000)**	
$LogM_2$	ADF	-2.172(0.496)	Non-Stationary	ADF	5.3019(0.001)**	Stationary
	PP	-2.075(0.551)		PP	14.831(0.001)**	

Variables	Test	At level @5%	Inference	Test	1st Difference @ 5%	Inference
LogINSE	ADF	-4.265(0.000)**	Stationary	ADF	-1.299(2.093)	Non-Stationary
	PP	-4.265 (0.000)**		PP	-1.299(2.093)	
$LogM_1$	ADF	-4.987 (0.003)**	Stationary	ADF	-2.456(4.670)	Non-Stationary
	PP	-5.980(0.000)**		PP	-2.567(2.340)	
MPR	ADF	-1.881(0.654)	Non-Stationary	ADF	-8.772(0.000)**	Stationary
	PP	-1.910(0.639)		PP	-8.772(0.000)**	
EXCH	ADF	-2.028(0.576)	Non-Stationary	ADF	-5.510(0.002)**	Stationary
	PP	-2.034(0.547)		PP	-9.565(0.000)**	

Note; the values in parenthesis present the p-values and the asterisks ** indicate a level of significance @5%.

Sources: Authors Computation (2019)

The results of the ADF and PP unit root shows that the variables attend different orders of integration i(0) and i(1) for which cause the Autoregressive Distributed Lag Model (ARDL) as established by Pesaran Shin and Smith (2000) was adopted.

Equation 3 is the baseline long-run model. Establishing a long-run relationship, and incorporating the short-run error correction procedure. The Error Correction Model developed by modifying Equation 3 as follows:

$$\Delta INF_t = \alpha_0 + \sum_{I=1}^{n} \alpha_{1i}\, \Delta INF_{t-1} + \sum_{I=0}^{n} \alpha_{2i}\, \Delta\, LogM3_{t-1} + \sum_{I=0}^{n} \alpha_{3i} \Delta\, LogM2_{t-1} + \sum_{I=0}^{n} \alpha_{4i} \Delta LogM1_{t-1} + \sum_{I=0}^{n} \alpha_{5i} \Delta LogGOVEX_{t-1} + \sum_{I=0}^{n} \alpha_{6i} \Delta LogINSE_{t-1} + \sum_{I=0}^{n} \alpha_{7i} \Delta MPR_{t-1} + \sum_{I=0}^{n} \alpha_{6i} \Delta EXCH_{t-1} + \beta_1 INF_{t-1} + \beta_2 LogM3_{t-1} + \beta_3 LogM2_{t1} + \beta_4 LogM1_{t-1} + \beta_{5L} LogGOVEXP_{t-1} + \beta_6 LogINSE_t + \beta_7 MPR_{t-1} + \beta_8 EXCH_t + U_t \ldots\ldots.(4)$$

Where; Δ = first difference operator

Other parameters: α_1 - α_8 = short-run and $\beta_1 - \beta_8$ = long-run relationship dynamics of the model

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$ (there is no co-integration).

Ha: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$ (there is co-integration)

5.3 Decision Rule

a. If the computed F-statistic is greater than the upper bound critical value, H_0 is rejected (the variables are cointegrated).

b. If the F-statistic is below the lower bound critical value, H_0 cannot be rejected (the variables are not cointegrated).

c. If the computed F-statistic falls between the lower and upper bounds, the results are (inconclusive).

Table 3 Estimation of the ARDL Regression Model

Dependent Variable: INFL
Method: ARDL
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (0 lag, automatic): LOGINSEC LOGM1 LOGM2 LOGM3 LOGTOT_EXP MPR EXCH
Fixed regressors: C
Number of models evaluated: 4
Selected Model: ARDL(4, 0, 0, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INFL(-1)	0.064	0.066	0.963	0.343
INFL(-2)	-6.00E	0.067	-8.87E	1.000
INFL(-3)	4.280	0.067	6.32E	1.000
INFL(-4)	0.437	0.2008	2.181	0.037
LOGINSEC	3.647	7.220	0.505	0.617
LOGM1	-31.426	20.177	-1.557	0.130
LOGM2	0.003	0.0017	2.033	0.051
LOGM3	-20.372	16.066	-1.267	0.215
LOGTOT_EXP	22.744	5.716	3.979	0.000
MPR	1.821	0.728	2.501	0.018
EXCH	0.069	0.026	2.604	0.014
C	245.083	208.625	1.174	0.250
Other Parameter Estimate				
R-squared	0.997557	Adjusted R-squared		0.996598
F-statistic	1039.592	Prob(F-statistic)		0.000000
Durbin-Watson stat	2.962285			

Sources: Authors Computation (2019)

The ARDL result in Table 3 displays the R^2 of 99% measuring model reliability and stability. The R^2 of 99% accounts for the variation between the dependent variable and the independent variables with a 1% unexplained variation. The F- statistic of (1039.592) and probability value of 0.000, validate the model reliability. The Durbin Watson Stat of (2.962) rules out possible first-order positive autocorrelation according.

Table-4. The ARDL long-run cointegrating result.

F-Bounds Test				
Selected Model: ARDL		**(4, 0, 0, 0, 0, 0)**		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	45.385	10%	1.92	2.89
K	7	5%	2.17	3.21**
		2.5%	2.43	3.51
		1%	2.72	3.9

The asterisks ** indicate a level of significance @5%

The F-statistic value of (45.385) in Table 4 is greater than the upper and lower bound critical value at a p-value of 0.05%. The Bound test result confirms the existence of a long run co-integrating relationship between inflation and other contributive factors instigating inflation in Nigeria.

Table-5. ARDL Model Short Run Error Correction Model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFL(-1))	-0.437989	0.046339	-9.451954	0.0000
D(INFL(-2))	-0.437989	0.046339	-9.451954	0.0000
D(INFL(-3))	-0.437989	0.046339	-9.451954	0.0000
CointEq(-1)*	-0.497859	0.021725	-22.91667	0.0000

The CointEq(-1) coefficient of -0.49 in Table 5 is statistically significant and the p-value of 0.000 estimate the short-run speed of adjustment from disequilibrium back to long-run equilibrium by 49%.

5.4 Pairwise Granger Causality

To determine the directional causality between inflation and the contributive variables the Pairwise Granger Causality test was conducted.

Table 6 Pairwise Granger Causality Tests

Sample: 1999Q1 2018Q4			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
LOGM1 does not Granger Cause INFL	78	0.79288	0.4564
INFL does not Granger Cause LOGM1		0.18893	0.0002**
LOGM2 does not Granger Cause INFL	78	0.23865	0.7883
INFL does not Granger Cause LOGM2		1.24900	0.008**
LOGM3 does not Granger Cause INFL	38	0.08974	0.9144
INFL does not Granger Cause LOGM3		0.27824	0.009**
LOGINSEC does not Granger Cause INFL	78	0.27486	0.0005**
INFL does not Granger Cause LOGINSEC		0.50715	0.6043
LOGTOT_EXP does not Granger Cause INFL	78	0.17359	0.8410
INFL does not Granger Cause LOGTOT_EXP		0.46740	0.0005**
MPR does not Granger Cause INFL	78	0.08083	0.98650.
INFL does not Granger Cause MPR		0.01358	0004**
EXCH does not Granger Cause INFL	78	0.64069	0.0009**
INFL does not Granger Cause EXCH		1.10116	0.3379

The asterisks ** indicate a level of significance @5%

The result in Table 6 confirms a causal relationship between other determining factors and inflation in Nigeria. The determining factors of the exchange rate, insecurity, government expenditure on infrastructural development, economic and social development, and corruption granger-causes inflation while there is no causal relationship between M_1, M_2 and M_3 money supply and inflation at a p-value of 0.05%. The findings confirm the findings of Diermeier and Goecke (2016); Amassoma, Keji, and Emma-Ebere, (2018) among others.

6. Discussion of Results

The results revealed that government expenditure on infrastructural development, economic and social development, exchange rate, monetary policy rate,

and M_2 money supply significantly impact on inflation in Nigeria. A unit increase in the exchange rate, monetary policy rate, and the M_2 money supply increases inflation by 69%, 1.82%, 0.3%; while government expenditure on poor infrastructural development, economic and social development impact on inflation at 22.74%. M_1 and M_3 money supply negatively impact on inflation. There is a long and short run significant co-integrating relationship between inflation and other determining factors. There is a causal relationship between other determining factors and inflation and a non-causal relationship between other determining factors and inflation in Nigeria. The results of this study validate the results of Okoye, Olokoyo, Ezeji, Okoh & Evbuomwan, (2019); Udo, Ben, Abner, Okoh, and Okolo (2019); Bashir, Yousaf, and Aslam (2016); Diermeier and Goecke (2016); Amassoma, Keji, and Emma-Ebere, (2018) among others.

7. Conclusion and Policy Implications

The core objective of this study is to examine other determining factors of inflation in Nigeria. findings showed that inflation is determined by other factors of government expenditure on security, economic and social infrastructural development, exchange rate, political instability, corruption, and double taxation, among others, other than money supply. The results confirm the claims of Okoye, Olokoyo, Ezeji, Okoh & Evbuomwan, (2019); Udo, Ben, Abner, Okoh, and Okolo (2019); Bashir, Yousaf, and Aslam (2016); Diermeier and Goecke (2016); Amassoma, Keji, and Emma-Ebere, (2018) among others. This study recommends that non-monetary factors of economic and social infrastructural development, exchange rate, political instability, corruption, and double taxation, should be controlled and security expenditure should be review along with-related mechanisms to achieve low inflation at single digits at most and economic growth and development.

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