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Inflation Anchoring, Exchange Rate and Sectoral Economic Growth in Nigeria

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Abstract: The Nigerian economy has been faced with high inflation rate, accompanied with a devastated exchange rate and a slow growth rate of the economy. The authors, in this paper, have examined inflation anchoring, exchange rate and sectoral economic growth nexuses in Nigeria. A multivariate cointegration approach was adopted. The result shows that inflation anchoring with a rising exchange rate would have contractionary effects on economic growth, agricultural output, industrial output and trade output in Nigeria. However, such policy would not have significant impacts on the building and construction sectors as well as service sector of the economy. The inflation threshold for Nigeria has been found to be 9 percent. Thus, inflation anchoring policy may be meaningful in Nigeria if exchange rate is well managed and the sub sectors of the economy are developed. A piecemeal disbursement of loan facilities for accountability, at low interest rate to the agricultural, industrial and trade sectors remains promising in promoting the growth of the sectors, while a low inflation rate is pursued and secured. Studies in future on the subject may essentially examine how inflation anchoring would affect economic growth in Nigeria without interacting inflation anchoring with exchange rate in their models.

Keywords: Inflation anchoring; Exchange rate; Sectoral economic growth; Cointegration

JEL Classifications: E31; F31; F43; C30

1. Introduction

The Nigerian economy has always been faced with the challenge of high level of inflation. This has made its central bank to continue to work hard to reverse the trend over the years. In the past four years, the central bank has strived to reduce the

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country's inflation rate from 15.68 percent in 2016 to 12.56 percent as at June 2020. The high inflation rate in Nigeria is accompanied with a devastated exchange rate and a slow growth rate of the economy. In order to critically manage an economy in this 21st century, it has been established that central banks should not reduce inflation while allowing the economic growth to suffer. Interestingly, achieving low inflation would produce economic growth in the long-run. It is also not a gainsaying that the Nigerian economic performance has suffered from sharp practices and loopholes that have been created in the system, among other factors which have negatively affected the exchange rate. A high inflation rate makes interest rate to be expensive thereby slowing down economic growth. Inflation anchoring is one policy window for achieving low inflation. Where a low inflation is pursued while other macroeconomic variables are allowed to fluctuate, inflation is said to be anchored.

In adopting the framework of inflation anchoring, responsibilities of the players must be spelt out in order to assess their transparency and accountability. As well known, in an open economy, a fluctuating exchange rate in a country affects its inflation rate. This is known as the exchange rate pass-through impact. The size of this impact affects central bank as it determines whether it should concentrate on controlling nominal exchange rate depreciation pressure which threatens price stability. Some studies such as Hattori & Yetman (2017) and Gondo & Yetman, (2018) have shown that the features of the pass-through might affect the rate of inflation which a central bank target.

Many empirics have shown that low inflation spurs economic growth (e.g. Fischer, 1993; Barro, 1995). The authors of these works, using both cross-sectional and panel data have found that high levels of inflation are injurious to economic growth either based on national or regional front. In recent times, it is becoming difficult for authors to arrive at this conclusion because inflation has become lower than it was in the 1970s and 80s in most countries of the world, yet economic growth has not increased as expected. Therefore, the conclusion on the inflation-economic growth nexus is becoming fragile. As a result, studies must continue to interrogate the debate. For example, the study by Gondo & Yetman (2018) concludes that there are no robust connections between economic growth and inflation. Similarly, a study by Hattori & Yetman (2017) concludes that evidences on the gains of low inflation to the economy are not very convincing.

Studies have continued to employ aggregate data to assess the causal impact of inflation on economic growth while including relevant control variables. This paper seeks to overcome the limitation of aggregate variables by using sectoral contributions to output and applying a difference-in-difference strategy such as the one used in the study by Cecchetti & Hakkio (2009). This has hardly been done for a developing country like Nigeria. The study differs from other studies on Nigerian economy by looking at how anchoring of inflation in the midst of volatile exchange rate can stimulate sectoral contributions to outputs

Following this section, part two reviews the relevant literature while in section three, the methodology is discussed. Section four presents the findings and discuss it while in the fifth part, conclusion and recommendations are drawn.

2. Literature Review

Inflation anchoring is based on the new Keynesian monetary policy drive. The policy framework is majorly characterized by official announcement of the targeted inflation rate for a stated time period; monetary policy design that aims at low and stable inflation rate as well as perceived accountability and transparency of the central bank (De Pooter, Rabitaille, Walker & Zdinak, 2014). This anchoring is flexible and uses discretionary monetary policy instrument to achieve low inflation. It is expected that central bank will act quickly to bring down inflation rate to avoid much variability in inflation compared to output. However, an economic shock such as a fall in oil price will raise inflation rate. The Keynesian has shown that there is no permanent trade-off between inflation and economic growth. According to the school, factors such as fiscal and monetary policy factors, expectation, labour wage and other prices will promote inflation and output growth in the short-run. Though, in the long-run, these factors and shock on the steady state of the economy lead to dynamic adjustment such that inflation-output variability trade-off will be positive initially but after some time will turn negative (Dornbusch, Fischer & Kearney, 1996). The monetarists concentrate more on the long-run dynamics of supply-side of the economy as against the short-run side (Dornbusch et al., 1996). They argued that increase in money supply or its velocity in excess of output growth is what causes inflation in the long-run.

Solow (1956) and Swan (1956) first advocated the neoclassical discourse on the subject. The conclusion of the school is missed. For example, Tobin (1965) concludes that inflation and output growth nexus is positive but Stockman (1981) argues otherwise. The endogenous growth model also supports a negative relationship of inflation among other variables with economic growth since inflation reduces investment return thereby reducing capital formation which reduces growth. Meanwhile, the depreciation of the exchange rate will increase economic growth (Marshall, 1923; Lerner, 1944; Speller, 2006). This Marshall-Lerner condition will happen where the addition of price elasticity of export demand and that of import demand is larger than unity. The Keynesian framework has shown that devaluation will enhance output through its influence on aggregate demand. Both IS-LM developed by Hicks (1937), advanced by Hansen (1953) and the Mundell–Fleming IS-LM developed by Mundell (1963) and Fleming (1962) support the exchange rate depreciation as having a positive effect on economic growth. However, exchange rate may not exhibit a complete pass-through (Obstfeld & Rogoff, 1995).

A number of studies on inflation anchoring employed survey data in their analysis. This method captures history on the subject and is independent of risk of secondary error. However, survey data analysis is not strong on the measurement of the extent of causal relationship between expected inflation and the actual inflation. Kozicki & Tinsley (2012) combined short-run and long-run expected inflation from their survey and actual inflation in an internal consistent manner to estimate inflation dynamic of the United States. Many studies did not enforce such internal consistency but employed econometric methods to compute inflation forecasts across different prospects. For example, Mehrotra & Yetman (2014) used a Weibull decay model. In this approach, the model-implied bound of the expected inflation is construed as the targeted inflation. Using the same method, Gondo & Yetman (2018) found anchored inflation to lie within the target inflation for all the countries examined.

Demertzis & Viegi (2009) find well-anchored inflation expectations in the euro zone at levels in consonance with the Euro system's target. This result is similar to the study by Cruijsen & Demertzis (2011) on the same eurozone while adopting a vector autoregressive approach. However, the study by Strohsal & Winkelmann (2015), using exponential smooth transition autoregressive dynamics method for European Monetary Union (EMU), US, Sweden and UK reveal a considerable varying degree of inflation anchoring across the region/countries and expectation levels.

The study by Audu & Amaegberi (2013) has found interest rate to have positive effect on inflation in Nigeria while increase in exchange rate shows a negative impact on the economy. Meanwhile, Ncube and Ndou (2011) using a sign restrained method of Bayesian VAR shows an inverse response of real rate of interest to inflation shock. The study further supports the Fisher effect and the argument for firm inflation targeting to promote economic growth. Besides, inflation targeting mechanism that is flexible and attaches relevance to real effective exchange rate also enhances economic growth. As noted earlier, inflation targeting is an important component of inflation anchoring. However, the conditions for targeting inflation must be met especially by emerging economies for them to achieve the targets set and by extension anchor inflation well. The foregoing review of the literature suggests a further need for analysis on how inflation anchoring and exchange rate would impact sectoral growth in Nigeria.

3. Theoretical Framework and Methodology

Our methodology draws from the theoretical background of rational inflation expectation theory which was propounded by John F. Muth in 1961 (Muth, 1961). The theory was later popularized in macroeconomics by Robert Lucas and Thomas Sargent. According to the rational expectation hypothesis, individuals use present obtainable and pertinent information in establishing their expectations. They refuse to rely on any past experience (Shaw, 1983). The theory says that expectations are rational since they efficiently include all available present information when the expectation is framed and not just the previous information.

In our inflation anchoring model, we access the degree of inflation anchoring by following the works of Levin, Natalucci & Piger (2004) and Choi, Furceri & Loungani (2018). Our equations are as follows:

$$\Delta INF_{t+h}^{e} = \delta^{h} INF_{t}^{news} + \varepsilon_{t+h} \quad (1)$$

Where ΔINF_{t+h}^{e} = the first difference of inflation expectations in h years, that is, h future period. The baseline year employed is the medium-term (5 years ahead) while a robustness check is conducted by expanding the scope of the period into short term and long-term horizons (1 and 10 years ahead respectively). Reverse causality and multicollinearity are minimized because expected inflation in medium-term are less collinear with lagged and current inflation levels.

The term INF_{t}^{news} measures inflation shocks. By definition, it is the difference between inflation expectations in short-term and actual inflation from the CBN statistical bulletin. The coefficient δ^{h} measures the extent of anchoring in h- years-ahead inflation expectations. It is called "shock anchoring" (Ball & Mazumder, 2011). The smaller the value of the coefficient, the well anchored inflation expectation is while the reverse is the other case. Therefore, after estimating the shock, the degree of inflation anchoring is the coefficient δ^{h}.

In addressing the interactive effect of the impact of the degree of inflation anchoring and exchange rate on various sectors' output performance, our procedures are as follows:

For the agricultural sector, we draw from the work of Yaqub (2010) and Mordi, Adebiyi, Adenuga, Adebayo, Abeng, Akpan, Evbuomwan. (2013) and we specify that:

$$AGRIC_{t} = \beta_{0} + \beta_{1} IA_{t} * EXCH_{t} + \beta_{2} IA_{t} * PLR_{t} + \beta_{3} IA_{t} * CPS_{t} + \beta_{4} IA_{t} * GOVCAP_{t} + \mu_{t} \quad (2)$$

Where t is the time period and μ is stochastic disturbance term. Other variables are denoted as follows:

AGRIC = Agricultural contribution to GDP

IA = Inflation anchoring degree

EXCH = Exchange rate

PLR = prime lending rate

CPS = Credit to private sector

GOVCAP = Government capital expenditure

The a priori expectations of the regression coefficients are $\beta_0 > 0, \beta_1 <> 0, \beta_2 < 0, \beta_3 > 0, \beta_4 > 0$

For the industrial sector, we draw from the studies by Mordi et al. (2013) and we specify that:

$IND_t = \lambda_0 + \lambda_1 IA_t * EXCH_t + \lambda_2 IA_t * PLR_t + \lambda_3 IA_t * CPS_t + \lambda_4 IA_t * GOVCAP_t + \mu_{2t}$ (3)

Where IND = Industrial sector's contribution to GDP and other variables are as earlier defined

The a priori expectations of the coefficients are $\lambda_0 > 0, \lambda_1 <> 0, \lambda_2 < 0, \lambda_3 > 0, \lambda_4 > 0$

For the building and construction sector, we specify that:

$BUILD_t = \psi_0 + \psi_1 IA_t * EXCH_t + \psi_2 IA_t * INV_t + \psi_3 IA_t * CPS_t + \psi_4 IA_t * GOVCAP_t + \mu_{3t}$ (4)

Where BUILD = Building and Construction sector's contribution to GDP and INV = Domestic investment while other variables' definitions remain.

The a priori expectations of the coefficients are $\psi_0 > 0, \psi_1 <> 0, \psi_2 > 0, \psi_3 > 0, \psi_4 > 0$

For the trade (Wholesale and Retail) sector, we specify that:

$TRADE_t = \xi_0 + \xi_1 IA_t * EXCH_t + \xi_2 IA_t * INV_t + \xi_3 IA_t * CPS_t + \xi_4 IA_t * GOVCAP_t + \mu_{4t}$ (5)

Where TRADE = Wholesale and Retail trade's contribution to GDP and other variables are as previously defined under equation (4).

The a priori expectations of the coefficients are $\xi_0 > 0, \xi_1 <> 0, \xi_2 > 0, \xi_3 > 0, \xi_4 > 0$

For services sector, we specify that:

$SERV_t = \phi_0 + \phi_1 IA_t * EXCH_t + \phi_2 IA_t * PLR_t + \phi_3 IA_t * CPS_t + \phi_4 IA_t * INV_t + \mu_{5t}$ (6)

Where SERV = Services sector's contribution to GDP while other definitions of variables remain

The a priori expectations of the coefficients are $\phi_0 > 0, \phi_1 <> 0, \phi_2 > 0, \phi_3 > 0, \phi_4 > 0$

We proceed to determine the threshold at which inflation affects the GDP. We noticed that threshold regression model was advanced by Khan & Senhadji (2001) for the analysis of inflation threshold for developing and developed countries. However, we adopt the model of Bawa & Abdullahi (2011) to estimate inflation threshold that affects Nigeria's GDP. Our GDP model to account for the inflation threshold effect is stated as follows:

$$GDP_t = \tau_0 + \tau_1 D_t * INF_t + \tau_2 PLR_t + \tau_3 CPS_t + \tau_4 INV_t + \mu_{6t} \quad (7)$$

D_t: 1 for $INF_t > K$

0 for $INF_t \leq K$

Where INF_t = Current year inflation rate, K = Threshold inflation

Data used which cover 1981-2017 were sourced from the Central Bank of Nigeria Statistical Bulletin, 2017.

4. Discussion of Findings

We begin with the discussion of the preliminary results of descriptive statistics in Table 1. It reveals a sharp depreciation of the exchange rate from a minimum of 0.61 to a maximum rate of 305.79 over the studied period. It further shows that the highest credit to private sector was 21.1 trillion naira while the least was 8.57 billion naira. The Jacque Bera normality test shows that given the acceptance rejection criteria, agricultural output contribution to GDP, exchange rate, GDP, government capital expenditure, industrial output contribution to GDP and prime lending rate were normally distributed since their probability values were more than 5% significance level. Nevertheless, the null hypothesis was not accepted for building and construction contributions to GDP, trade contribution to GDP, service contribution to GDP, domestic investment and credit to private sector.

Table 1. Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Skewness	Jarque-Bera	Prob	Obs
AGRIC	7.43 tr	4.70 tr	17.2 tr	2.30 tr	0.649674	4.491192	0.105	37
BUILD	1.00 tr	0.679 tr	26.8 tr	0.336 tr	1.241479	9.537317	0.008	37
CPS	4.19 tr	0.431 tr	21.1 tr	8.57bill	1.369181	11.73851	0.003	37
EXCH	82.78627	92.69335	305.7901	0.610025	0.713608	3.167107	0.205	37
GDP	32.7 tr	22.4 tr	69.0 tr	13.8 tr	0.801593	5.099944	0.078	37
GOVCAP	0.39 tr	0.270 tr	1.16 tr	4.10 bill	0.625666	3.946986	0.139	37
IND	9.39 tr	8.56 tr	13.8 tr	5.26 tr	0.136120	2.593838	0.273	37
INV	5.41 tr	2.87 tr	16.9 tr	1.80 tr	1.253209	9.852748	0.007	37
PLR	17.59486	17.58000	29.80000	7.750000	0.189738	0.727478	0.695	37
SERV	10.2 tr	6.45 tr	25.4 tr	3.67 tr	0.964841	6.264668	0.044	37
TRADE	4.70 tr	2.63 tr	11.7 tr	1.66 tr	0.969762	6.535250	0.037	37

The denotation tr and bill mean trillion and billion in Nigerian naira

Source: Authors' computation

Next is the unit root test using the Augmented Dickey Fuller test developed by Dickey & Fuller (1981) which result in Table 2 shows that all the variables were stationary at first difference. Based on this result, a cointegration analysis is conducted to ascertain whether an equilibrium relationship exists among the variables. Two approaches were employed for the cointegration which are – the Johansen and the Engle-Granger tests

Table 2. Augmented Dickey-Fuller (ADF) Unit Root Test Result

Variable	Method	At Level			At First Difference			Order
		ADF statistics	5% critical value	Prob	ADF statistics	5% critical value	Prob	
LOG(AGRIC)	ADF	0.145292	-2.945842	0.9649	-5.796339**	-2.948404	0.0000	I (1)
LOG(BUILD)	ADF	1.139875	-2.945842	0.9971	-3.388935*	-2.948404	0.0182	I (1)
LOG(CPS)	ADF	-0.758075	-2.945842	0.8188	-3.601159*	-2.948404	0.0108	I (1)
EXCH	ADF	2.238121	-2.945842	0.9999	-3.303320*	-2.948404	0.0223	I (1)
LOG(GDP)	ADF	0.032155	-2.98404	0.9553	-3.339735*	-2.948404	0.0205	I (1)
LOG(GOVCAP)	ADF	-1.207801	-2.98404	0.6600	-6.168757**	-2.948404	0.0000	I (1)
LOG(IND)	ADF	-0.771038	-2.945842	0.8152	-5.464490**	-2.948404	0.0001	I (1)
LOG(INV)	ADF	-0.122677	-2.954021	0.9387	-3.260900*	-2.954021	0.0252	I (1)
PLR	ADF	-2.411968	-2.951125	0.1461	-5.904707**	-2.951125	0.0000	I (1)
LOG(SERV)	ADF	0.255580	-2.98404	0.9724	-3.195691*	-2.948404	0.0460	I (1)
LOG(TRADE)	ADF	0.108518	-2.98404	0.9619	-3.079351*	-2.948404	0.0374	I (1)

** Indicates significant at 5%, thus, the variable is stationary at that order*

*** Indicates significant at 1%, hence, the variable is stationary at that order*

Source: Authors' Computation

The Johansen test is a multivariate generalization of the ADF test which examines the linear cointegration of variables (Johansen, 1991; Maddala & Kim, 1998). It is a maximum likelihood estimation approach that makes it possible to estimate all co-integrating vectors when there are more than two variables. If there are three variables each with unit roots, there are at most two cointegrating vectors. An absence of a long run relationship or equilibrium relationship between the variables coincides with zero coefficients for the variables in the model. A rejection of null hypothesis indicates that there is a long-run relationship.

Table 3. Johansen Co-integration Test Result

Models according to objectives	Hypothesized No. of Cointegrating Equations	Eigen Value	Trace Statistics	5% Critical Value	Probability
Aggregate Output Equation	None **	0.620730	79.79092	69.81889	0.0065
	At most 1	0.523392	45.85814	47.85613	0.0761
	At most 2	0.306086	19.92098	29.79707	0.4282
	At most 3	0.164646	7.131745	15.49471	0.5624
	At most 4	0.023582	0.835246	3.841466	0.3608
Agricultural Sector Equation	None *	0.620210	73.19566	69.81889	0.0262
	At most 1	0.421369	39.31087	47.85613	0.2481
	At most 2	0.273683	20.16269	29.79707	0.4119
	At most 3	0.223958	8.970759	15.49471	0.3681
	At most 4	0.002755	0.096568	3.841466	0.7560
Industrial Sector Equation	None *	0.705030	73.19400	69.81889	0.0262
	At most 1	0.359973	30.46308	47.85613	0.6951
	At most 2	0.238894	14.84452	29.79707	0.7901
	At most 3	0.135499	5.290146	15.49471	0.7773
	At most 4	0.005528	0.194029	3.841466	0.6596
Building and Construction Equation	None *	0.622082	73.71602	69.81889	0.0236
	At most 1	0.459695	39.65833	47.85613	0.2350
	At most 2	0.249394	18.11156	29.79707	0.5578
	At most 3	0.161830	8.070966	15.49471	0.4579
	At most 4	0.052629	1.892261	3.841466	0.1689
Wholesale and Retail Trade Equation	None **	0.696969	85.07232	69.81889	0.0019
	At most 1	0.480913	43.28510	47.85613	0.1258
	At most 2	0.309298	20.33615	29.79707	0.4003
	At most 3	0.151029	7.384509	15.49471	0.5334
	At most 4	0.046156	1.653935	3.841466	0.1984
Service Sector Equation	None *	0.636283	71.71794	69.81889	0.0350
	At most 1	0.425113	36.31968	47.85613	0.3804
	At most 2	0.241770	16.94431	29.79707	0.6442
	At most 3	0.170696	7.257412	15.49471	0.5479
	At most 4	0.019984	0.706532	3.841466	0.4006

** Connotes significant at 5%, hence, the number of co-integrated equations*
*** Indicates significant at 1%, thus, the numbers of co-integrated equations*
Source: Authors' Computation

Table 3 presents the Johansen co-integration result for the 6 models as specified in the preceding section. The first equation is used to examine how inflation anchoring affects GDP, that is, the aggregate output. The second, third, fourth, fifth and sixth equations examined the effect of inflation anchoring on agriculture, industry, building and construction, wholesale and retail trade as well as services sector contribution to GDP, respectively. The result revealed that at 5% significance level, there is one co-integrating vector among the variables in the aggregate output model and all the 5 disaggregated models. Therefore, there was no reason to accept the null hypothesis of no co-integration among the variables. However, Table 4 reveals that one of the equations is not co-integrated using the Engle Granger co-integration test. This approach was developed in the research of Engle and Granger (1987).

Table 4. Engle Granger Co-integration Test Result

Model	Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
Aggregate Output Equation	LOG(GDP)	-8.997238	0.0176	-34.74673**	0.0002
Agricultural sector equation	LOG(AGRIC)	-8.234166	0.0054	-36.28530*	0.0122
Industrial Sector Equation	LOG(IND)	-2.189016	0.9087	-291.5898**	0.0000
Building and Construction Equation	LOG(BUILD)	-11.424890	0.0000	-45.21998**	0.0000
Wholesale and Retail Trade Equation	LOG(TRADE)	-10.212141	0.0000	-37.07917*	0.0227
Service Sector Equation	LOG(SERV)	-2.797728	0.7078	-11.41291	0.8068

** Indicates significant at 5%, hence the equation is co-integrated*
*** Indicates significant at 1%, thus the equation is co-integrated.*
Source: Authors' Computation

In the main section, we estimate inflation anchoring. Following the model specified in equation (1), the estimated result is presented below:

$$\Delta \widehat{INF}^{e}_{t+5} = 0.203976 INF^{news}$$
$$(1.938)$$

The baseline result shows that monetary policy is a bit 80% credible. That is, only about 20% inflation expectation is gotten in response to a 1 percentage change in inflation. A robustness check reveals that the degree of inflation expectations only increased by 1% to 21%. Examining the effect of anchoring of inflation rate and exchange rate on the real GDP and the sub-sectors' outputs, an error correction model was employed. The choice of ECM approach was because all of the variables were stationary at first difference; most of the models were cointegrated and monetary policy is more effective in the short-run. The result on the aggregate output model is presented in Table 5. The model has a strong goodness of fit and there is no suggestion of serial correlation as the Durbin Watson is within a reasonable bound. The coefficient of the error correction is rightly signed and it shows about 37.4% of the deviation from the long-run or equilibrium is corrected in the short-run.

Table 5. ECM Estimated Result on Output Equation

Dependent Variable: ∆GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ (EXCH * IA)$_t$	-0.003735**	0.001149	-3.251028	0.0044
Δ (EXCH*IA)$_{t-1}$	-0.002895	0.001720	-1.683639	0.1095
ΔLOG(GOVCAP)$_t$	-0.011575	0.012857	-0.900268	0.3799
ΔLOG(GOVCAP$_{t-1}$	0.030345	0.016484	1.840840	0.0822
ΔLOG(GOVCAP$_{t-2}$	-0.040347*	0.017001	-2.373186	0.0290
ΔLOG(INV)$_t$	0.150553**	0.029478	5.107323	0.0001
ΔLOG(INV$_{t-1}$	-0.033762	0.028173	-1.198365	0.2463
ΔLOG(INV$_{t-2}$	0.085798**	0.023635	3.630111	0.0019
ΔLOG(CPS)$_t$	0.001587	0.028309	0.056068	0.9559
ΔLOG(CPS$_{t-1}$	-0.057941	0.030553	-1.896418	0.0741
ECM$_{t-1}$	-0.373734*	0.114378	-3.267541	0.0043
R-squared	0.999333			
Adjusted R-squared	0.998778			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	2.155550			

** Significant at 5%*
*** Significant at 1%*
Source: Authors' Computation

The result in Table 5 further reveals a statistically significant indirect effect of exchange rate interaction with inflation anchoring on economic growth. This is in a way in line with the work of Audu & Amaegberi (2013) and Falana (2019) but contrary to the studies by Marshall (1923), Hicks (1937), Lerner (1944), Flemming (1962), Mundell (1963) and Speller (2006) on the nexus between exchange rate and growth. The implication of this result is that inflation anchoring in the midst of a depreciating exchange rate has contractionary effect on economic growth in Nigeria. However, government capital expenditure in the past two years, domestic investment in current year and in two previous years have expansionary effect on economic growth in Nigeria.

Table 6. ECM Estimated Result on the Five Sector Output Equations

	Agric		Industry		Building		Trade		Services	
Variable	Coefficient	Prob	Coefficient	Prob	Coeffici.	Prob	Coeffici.	Prob	Coefficient	Prob
Δ (EXCH*IA)	0.002201	0.4897	-0.007340**	0.0060	-0.000354	0.8666	-	-	-0.002906	0.0872
Δ (EXCH*IA)$_{t-1}$	-0.017418**	0.0008	-0.006796*	0.0553	-	-	-0.00065*	0.0212	-0.001577	0.5746
Δ (PLR$_t$	0.003869	0.1447	0.003770	0.1096	-	-	-	-	0.002159	0.1967
Δ (PLR$_{t-1}$	-	-	-0.003268	0.2623	-	-	-	-	0.00370*	0.0400
ΔLOG(CPS$_t$	0.093708*	0.0410	-0.010397	0.8575	0.07865*	0.0414	0.1240**	0.0034	0.06260*	0.0010
ΔLOG(CPS$_{t-1}$	-	-	-0.129535*	0.0326	-	-	-	-	-	-
ΔGOVCAP)	-0.041282	0.2288	-0.008647	0.5888	-0.011939	0.6905	-0.014581	0.6374	-	-
ΔlogGOVCAP$_{t-1}$	0.113141**	0.0069	-	-	-	-	-	-	-	-
ΔLOG(INV)$_t$	-	-	-	-	0.135556	0.0572	0.024712	0.7241	0.040162	0.3397
ΔLOG(IND$_{t-1}$	-	-	0.169422	0.2010	-	-	-	-	-	-
ΔLOG(BUILD)$_{t-1}$	-	-	-	-	0.244338	0.1147	-	-	-	-
ΔLOG(TRADE$_{t-1}$	-	-	-	-	-	-	0.407**	0.0191	-	-
ECM$_{t-1}$	-0.568023**	0.0001	-0.905824**	0.0000	-0.3843**	0.0008	-0.24064*	0.0401	-0.2944**	0.0114
R-squared	0.994644		0.984963		0.991620		0.996343		0.998921	
Adj. R-squared	0.992716		0.976761		0.989825		0.995027		0.998274	
Prob(F-statistic)	0.000000		0.000000		0.000000		0.000000		0.000000	
D-Watson stat	2.306083		1.860733		2.053602		2.131892		2.296231	

** Indicates significant at 5%*
*** Indicates significant at 1%*
Source: Authors' Computation

The results on the sub-sectors are presented in Table 6. The models have strong goodness of fit and their Durbin Watson statistics are within reasonable bounds. The coefficient of the ECM of the agricultural sector's model is correctly signed. Approximately, 56.8 percent deviation from the long-run was corrected in the short-run. There is a statistically significant contractionary impact of exchange rate interaction with inflation anchoring on previous year agricultural output growth. This is somehow consistent with the work of Yaqub (2010) and Falana (2019). The result also shows that first lagged government capital expenditure and credit to private sector have a positive and significant impact on agricultural output which conform to a priori expectations. The ECM of the industrial sector model is rightly signed. Almost 90.58 percent deviation from equilibrium was rectified in the short-run. There is an indirect significant impact of exchange rate interaction with inflation anchoring on industrial output growth. Like agriculture, the result is somehow consistent with the findings of Yaqub (2010) and Falana (2019). The building and construction model also have a correctly signed ECM. Approximately, 38.43 percent deviations from long-run equilibrium was rectified in the short-run. There is an insignificant indirect impact of exchange rate interaction with inflation anchoring on building and construction output growth. Besides, the trade and service models have correctly signed ECMs such that about 24.1 percent and 29.4 percent deviations, respectively, from long-run were rectified in the short-run. There is a statistically significant indirect impact of exchange rate interaction with inflation anchoring on trade output growth which someway supports the finding of Falana (2019). However, the impact of exchange rate interaction with inflation anchoring on service output growth is statistically insignificant.

Table 7. Spline Regression Estimated Result

Dependent Variable: GDP

	@6% threshold		@7% threshold		@8% threshold		@9% threshold		@10% threshold	
Variable	Coefficient	Prob	Coefficient	Prob	Coeffici.	Prob	Coeffici.	Prob	Coefficient	Prob
C	23.76190	0.0000	24.02060	0.0000	23.81762	0.0000	23.86924	0.0000	23.89513	0.0000
IA*EXCH	0.001131	0.5561	0.001391	0.4657	0.001095	0.5682	0.001233	0.5271	0.001295	0.5074
INF	-0.000582	0.4700	-0.001069	0.1913	-0.000927	0.3069	-0.000506	0.5716	-0.000452	0.6097
(INF-K)	0.019665	0.6644	-0.041811	0.2638	-0.016377	0.6514	-*0.012435*	*0.0005*	-0.015734	0.0000
LOG(GOVCAP)	-0.079258	0.0041	-0.078229	0.0037	-0.077594	0.0060	-0.082777	0.0029	-0.082471	0.0027
LOG(INV)	0.102026	0.0019	0.095586	0.0029	0.101555	0.0019	0.099097	0.0024	0.098287	0.0026
LOG(CPS)	0.233176	0.0000	0.229987	0.0000	0.230487	0.0000	0.235503	0.0000	0.234993	0.0000

R-squared	0.987140	0.987594	0.987147	0.987131	0.987184
Adjs R-squared	0.984568	0.985113	0.984577	0.984558	0.984621
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000000	0.000000
D-Watson stat	1.772950	1.902140	1.837733	1.786127	1.762730

** Implies significant at 5%*
*** Implies significant at 1%*
Source: Authors' Computation

On the threshold result in Table 7, at an arbitrary threshold of 6%, the adjusted impact of inflation rate (INF-K) on output was positive but when it was increased to 7%, it became negative nonetheless statistically insignificant. The insignificance was also the case at 8% but at 9% threshold, the impact became negative and statistically significant even beyond the level. Therefore, the inflation threshold beyond which it becomes detrimental to the Nigerian economy is 9 percent. This is more realistic compared to 13 percent found in the study by Bawa & Abdullahi (2011) on the Nigerian economy.

5. Conclusion and Recommendations

In this paper, we have examined inflation anchoring, exchange rate and sectoral economic growth in Nigeria. Inflation anchoring with a rising exchange rate would have contractionary effects on economic growth, agricultural output, industrial output and trade output in Nigeria. Unfortunately, inflation anchoring with a depreciating exchange rate would not make significant effect on the building and construction output as well as service output in Nigeria. Therefore, this study has laid credence on the need to develop the agricultural and the industrial sectors of the Nigerian economy so that where inflation is anchored and exchange rate is at the same time devalued, they can promote the growth of outputs in the country. The agricultural and industrial sectors must continue to be promoted by the Nigerian government and its establishments including the Central Bank of Nigeria through provisions of low interest rate facilities. The loans must be disbursed in piecemeal to monitor performance and ensure effective utilization. Also, every state government must extensively delve into mechanized farming while emphasis should be on broadening of the agricultural value chain. As well-known from the economic literature, exchange rate devaluation would only be beneficial to the economy if the production base of the economy is strengthened. As enunciated above, there must be appropriate lending policies and government must rapidly rejuvenate the soft and hard infrastructures, especially institute efficient transport system, functional education and health system, clean water system and serious maintenance of law and order. Besides, the merchandize business which is flourishing in Nigeria must be developed further to promote economic growth in Nigeria but emphasis must be placed more on production than trading. The required development is in terms of trade which have to shift from foreign goods to locally made goods except for goods that Nigeria does not have comparative advantage. In addition, the monetary authority should unify its exchange rate system as the multiple exchange rate system has been compromised, hence not achieving its desired objectives.

The inflation threshold for Nigeria has been found to be 9 percent. Therefore, while it is exigent for Nigerian government to expand the economy, a hybrid inflation anchoring policy needs to be pursued. By implication, the monetary authority must not only target a single-digit inflation rate through a tight monetary policy, it must also extend credit to needed sectors of the economy that would promote economy growth and create jobs. This is not a contradictory approach as could be implied by conservative monetary policy but a way of simultaneously achieving low inflation and economic growth.

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