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ESTIMATION OF THE SACRIFICE RATIO BETWEEN INFLATION AND GROWTH IN NIGERIA

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ABSTRACT

Relying on the adaptive expectations Augmented Phillips Curve approach, the study estimated the sacrifice ratio for inflation that is conducive for growth in Nigeria and found the ratios for the constructed models I and II to be positive. The sacrifice ratio measures how much output is lost in the country when inflation is reduced by 1 percentage point through monetary policy action. The outcome of our study suggests that a 1 percent disinflation accomplishment leads to an output loss of 0.07%. Also, for a given period, power of persistence effect coefficient is 0.71 on the average, suggesting that, disinflation policy has a more robust and long-lasting impact on the country's real GDP.

JEL classification: C13, E31, E52

Keywords: Phillips curve; Averaged inflation; Sacrifice ratio and output gap

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1. Introduction

One of the most crucial tasks of a monetary authority is to control the movement in the general price level in any given country and ensure that movement does not veer too far off from its set threshold. In Nigeria, the Central Bank sets a single-digit inflation target band of 6-9 per cent that is considered to be conducive to the nation's economic growth, but while inflation, over the years had largely sauntered within this target bracket, it had recently shot up far above the upper limit band, triggering series of defensive policy action from the monetary authority. However, taming inflation in an economy that is characterized by dipping growth and revitalized cyclical and structural unemployment (stagflation) comes with a cost. The extent of that cost is usually measured by the sacrifice ratio. This ratio is defined as the cumulative output loss that must be sacrificed to ease inflation by a percentage point. Policymakers would like to know how high the cost of disinflation would be when they commence reductive inflation policy in order to accommodate growth.

Economists have suggested variety of ways to determine the sacrifice ratio, while recognizing that, countries vary in their peculiarities. Whereas some authors proposed the use of the initial level of inflation, others suggested the use of inflation history measured with a geometric lag as a better gauge of the inflation environment at the start of a disinflation. The inflation history variable is usually leveraged on to reconcile the contradictory evidence from episode-specific and cross-country studies. Ball, et al (1988) examines the effect of the average rate of inflation on the short-run tradeoff between output and inflation in a cross-country study. The outcome of the study indicates that higher mean inflation escalates the frequency of price adjustment, thereby making the Phillips curve to be steeper with a corresponding small sacrifice ratio. In like manner, the study posited that countries with low inflation would have a relatively flat Phillips curve and a corresponding large sacrifice ratio. Nevertheless, this assertion is not tenable when probing episode-specific studies, when insignificant relationship between average inflation and slope of the Phillips curve had been noted.

Nigerian economy had witnessed different intensity in inflation even as recently as 2016 when the economy plunged into stagflation, an uncommon phenomenon characterized by undesirable combination of high inflation, high unemployment and low growth. Notwithstanding, however, the challenges associated with the unstable path of inflation and growth in the country over the years, the need to test the applicability of one of these techniques to identify the best path for Nigeria is the motivation for this study.

Consequently, this study is specifically aimed at estimating the sacrifice ratio between inflation and output for Nigeria using the conventional sacrifice ratio estimates with some modification.

Following the introduction, Section 2 of the paper examines the conceptual and theoretical basis for the study as well as empirical literatures on the sacrifice ratio. Section 3 presents a description of data, models and methods of analysis employed, section 4 presents and discusses the results while Section 5 concludes the paper with some policy recommendations.

2. Some Stylized facts on Nigeria's Policy Environment

2.1 Appraisal of the Policy Environment

Nigeria's monetary policy environment has had its share of checkered history since its establishment in 1959. Policy response, like most Central Banks, had mostly been directly consequential of the prevalent economic reality, and these responses had also been a function of the degree of independence enjoyed by the Bank. Prior to 1986, monetary policy was guided by an economic environment driven by the oil sector, the external sector dynamics and the dependence on the expanding public sector of the economy. Towards achieving its price stability mandate and a dose of robust balance of payment position, the Nigerian monetary authority had depended on deployment of traditional policy instruments, like credit ceilings, targeted costs of fund control, managed interest and exchange rates; cash reserve requirements and also special lending/deposit facility. Subsequent amend-

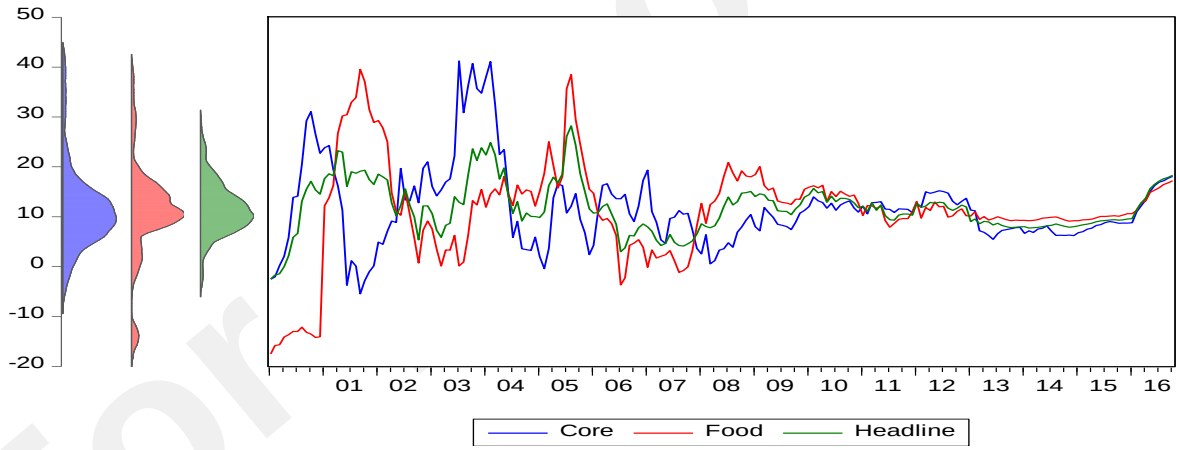
ment of the CBN Act after 1986 conferred more autonomy and wider discretion on the Central Bank of Nigeria in the conduct of monetary policy, subsequently, causing policy objectives to direct focus from economic growth to price stability, (Adeoye, Ojapinwa, & Odekunle, 2014).

According to Ebiringa, Onuorah & Obi (2014), promulgation of credit rationing guidelines, that set the rates for deposit money banks' loans and advances to the private sector became the favorite monetary policy instrument of the Central Bank of Nigeria, with the primary objective of stimulating the productive sectors and consequently taper inflationary pressures. The Bank has also been aggressive in its developmental policy, pumping record billions into the real sector of the economy, like the agricultural, textile, aviation and airline industries. The Bank, in attempts to jumpstart the economy through this unconven- tional policy, also intervened in the intractable clashes between sub-national governments and their employees, stemming from backlogs of salary arreas. Selecting price stability as core mandate is not a random choice from a menu of competing objectives, it was a decision that was properly anchored in history, as inflation is still considered one of the major impediments to growth in the country.

Nigeria has had a fair share of high inflation bouts. According to (CBN, Statistical Bulletin, 2009), the first episode of long-lived high inflation at the 30 per cent range (one year moving average) was in 1976. This hyperinflation was ocassioned by a record drought in the Northern part of Nigeria which devastated farm produce and led to prices of food items skyrocketing. Another contributory factor was the excessive monetization of oil exports which further exercebated the problem.

Fig. 1

Nigeria's Headline, Core and Food Inflation, 2000M1 - 2016M10



The second episode of high inflation was recorded in the 1980s, with the effect of wage increases, following the Structural Adjustment Program which created a cost-push inflationary effect on the economy. The then structural characteristics of the economy coupled with increased money supply, having such an uncanny resemblance to the current situation that perpetuated price increases. Inflation reached a peak of 39.6 per cent in 1984, accompanied by tapered economic output growth. Moreso, the Federal authority was under incessant pressures from debtor-lobbyists urging it to make some bargain with the IMF, by accepting to devalue its domestic currency. This invariably led to the expectations of impending devaluation passing through to consumer prices, in addition to both high powered money and credit to the government rising dramatically, (CBN, Statistical Bulletin, 2010). It is therefore, apparent that the 2016-2017 economic malaise is historically evocative of the past fiscal and structural challenges in the country.

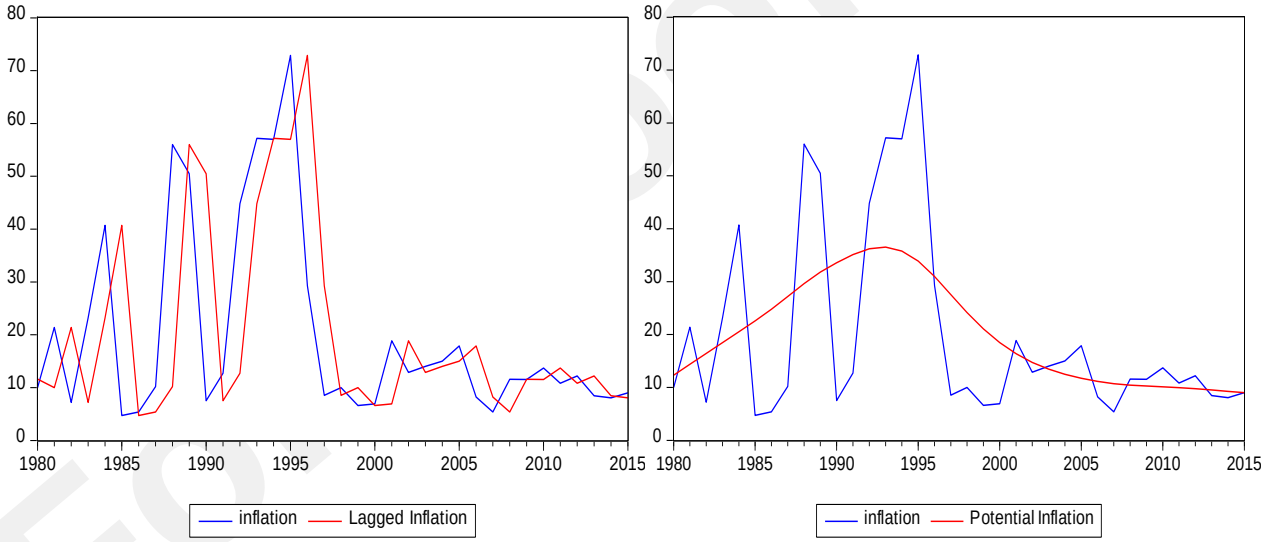
The country witnessed the third high and long-lived inflation episode in quarter four of 1987 that lasted through 1989. This particular episode was

attributed to the fiscal expansion stemming from the 1988 budget, which was initially financed through CBN credit, before the government stumbled on a lifeline from the unsterilized oil revenue windfall that followed the Persian Gulf War. Another driver of the inflation was the 'debt for equity' swaps initiated by the government that saw external debts being purchased with local currency obligations. However, the drastic contractionary stance embarked upon by the authorities, especially via monetary contraction around mid-1989, having peaked at an average of about 56 per cent in 1988, forced inflation down, reaching a record low of 13 per cent in 1991, (CBN, Statistical Bulletin, 2010).

The fourth inflation episode was witnessed in the country between 1993 and 1995, when it started out at 57.2 per cent and peaked at 72.9 per cent, the highest since the eighties till date, (CBN, Statistical Bulletin, 2009). The main driver of the fourth bout is similar to that of the third: expansionary fiscal deficit and money suppy growth, stemming from growth of private sector domestic credit and deposit money banks liquidity. Since 1996, however, inflation growth speed had significantly moderated, with an average rate of 12 per cent from 1996 through 2015, as a result of stern policy stance of the Central Bank of Nigeria.

While inflation has moderated over the years, it has modestly been on the upward trrend since the Q2 of 2014, but the rise has been insignificant, largely hovering within the monetary policy inflation threshold of 6 – 9 per cent. This however has given rise to a more accelerated growth rate of inflation, especially, since the Q2 of 2015, when the upperbound of the policy target threshold was breached, at 17.2 per cent.

Fig. 2 Actual, Lagged and Potential Inflation

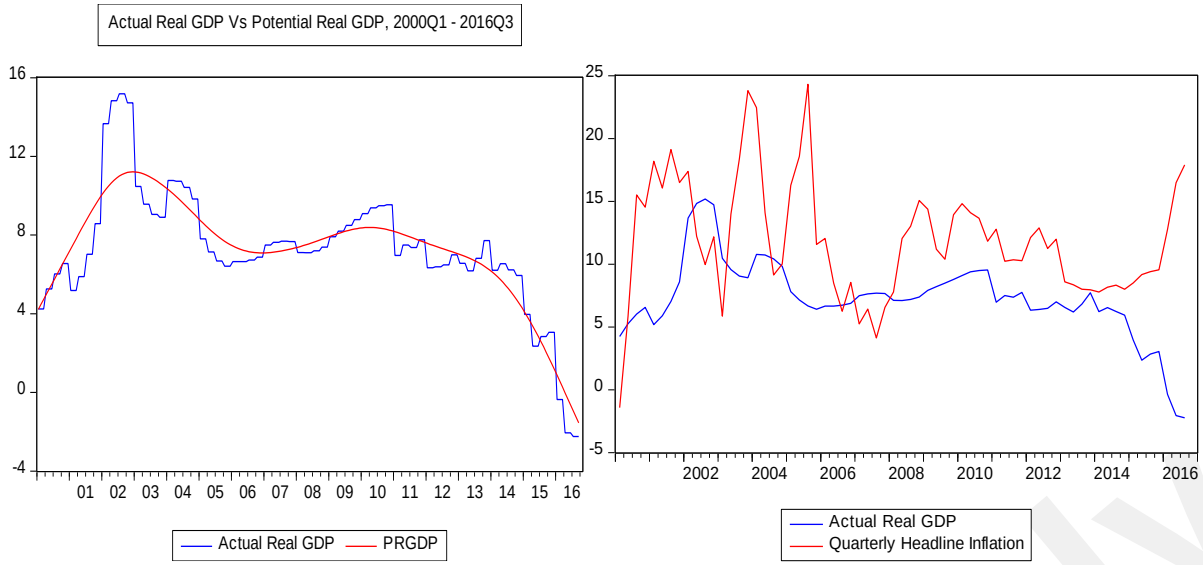


In spite of the best efforts of the Bank, inflation and unemployment have continued their upward movements while growth took the opposite direction into the negative realm, thrusting the economy into a stagflationary situation. This outcome has prompted the insalubrious reality that monetary policy has reached its limit, even as the unconventional policy through intervention funds has also thus far yielded measured results. Given the structural nature of the economic challenges, the general consensus supports the fiscal authority coming up with robust policy to reflate and reverse the stragflationary trend ravaging the economy.

2.2. Performance and Analysis of Macroeconomic Variables

While the impact of fall in the commodity prices reverberated across the global economy, the most significant is the fall in the prices of oil, which accounts for about 90 per cent of Nigerian foreign exchange earnings.

Fig. 3



2.2 Review of Literature

Sacrifice ratio conventionally quantifies the loss in potential output in the short to medium term, brought about by deliberate policy actions to achieve a one percentage point reduction in the long run inflation. In other words, it is a measure of the output cost of inflation or according to Çetinkaya & Yavus (2012), is the "total deviation in output from its trend over the change in the trend inflation". Monetary authorities, especially, those whose operational mandate hinges on price stability have long struggled with the level of opportunity cost of disinflation they are willing to bear vis-à-vis a foregone economic growth opportunity. A body of research has applied econometric method to study the tradeoff cost of disinflation. Ascari & Ropele (2009) deployed the New Keynesian DSGE model and following Smets & Wouters (2003), and Schmitt-Grohe & Uribe (2005), complemen- ting the transitional analysis of the short-run costs with robust welfare evaluation, and concluded that, in spite of the long-lived downturn in the general economic activities, disinflation occasions non-zero welfare gains.

There are different approaches to estimating the sacrifice ratio. Mazumder (2014) probed the effect of using either core or headline inflation on the sacrifice ratio outcome, he found that headline inflation tends to produce more disinflation episodes than does the core inflation. He noted that this is remniscent of what economists observed during the Great Recession, while the episodes usually are shorter in length. The author, in addition, also found that preference for cold-turkey approach to disinflation significantly dissipates when adding core inflation with sacrifice ratio measures which allows for varying persistent effects on output as a result of disinflation.

Okun (1978), and later, Gordon & King, (1982) were among the first to use the adaptive expectations Augmented Phillips Curve approach to measuring sacrifice ratio. This approah allows for the curve to robustly capture the output-inflation tradeoff for a given time period. The first step to properly quantify the inflation-output tradeoff, is sieving through the clusters and distinguishing the useful disinflation episodes between peaks and troughs on a plotted inflation graph. Çetinkaya & Yavus (2012), following Ball (1994) defined the inflation peak and trough as a "point in time where the trend inflation is higher or lower than the previous and the next four quarters. Subsequently, they described inflation episode as the period starting with an inflation peak and ending with an inflation trough. Some modification is evident in this description, as Bell (1994) originally described disinflation episodes as a period when trend inflation falls substantially, and the trend inflation itself as a centered, nine-quarter moving average of actual inflation.

Zhang (2001), on his own part, opined that there

is a larger downward bias for countries with larger long-lived effects in the standard method for measuing sacrifice ratio proposed by Ball (1994). As such, he concluded that the assumption about output converging to its potential level within four quarters at the end of a specific episode may undervalue disinflation episode cost. Jordan (1997), in his own study tried to link central bank independence with the cost of disinflation and gains of accelerating inflation, the author calculated the ratios for 19 industrial nations between 1960 and 1992. The study found that central bank independence only matters during disinflation episodes. Put differently, the greater the sacrifice ratio vis-avis the output loss, the more independent a central bank tend to be. Conversely, central bank independence has no bearing on either the sacrifice ratio or the output gain during accelerating inflation episodes. This conclusion essentially is in line with the longstanding belief that independent central banks tend to have lower inflation rate.

In their own study, Ball, Mankiw, & Romer (1988) argued in support of the Keneysian view of Business cycle, in which John Maynard Keynes averred that nominal shocks have real effects on inflation due to infrequent changes in nominal prices. The model assumes that any increase in the average rate of inflation tends to elicit firms to adjust prices so as to keep up with the rising price level. This, they further argued that frequent price changes imply that prices adjust quicker to nominal shocks but with the real effects of the shock being smaller. Mazumder (2012) estimated world-wide sacrifice ratios spanning approximately forty years period, in addition, the author also tested for the speed of disinflation, openness of the economy, central bank independence, inflation targeting and political factors for the select countries. The author found that, while the speed of disinflation is the most significant determinant of OECD sacrifice ratios, it has no impact on non-OECD countries's cost of disinflation. However, the Author found that greater central bank independence as well as more openness have causative effect on lower sacrifice ratio for non-OECD countries. The study also concluded that while government debt-to-GDP ratio is not significant to OECD nations, the reverse is the case for non-OECD countries, given that higher debt/GDP ratio is associated with lower sacrifice ratio in non-OECD countries. It is thus concluded that higher level of national debt does not authomatically translate to heightened inflation expectation.

Given the assumed shortfall in Ball (1994) prescribed method of selecting disinflation episodes, where the method restrains the episodes to those where trend inflation at the commencement of an episode is low or moderate, and all cases of hyperinflation are automatically rejected; Mazumder (2013), attempted to study the possible outcome in a situation where the high disinflation episodes are are not selected. The author found the scarifice ratio to be lower; but also found that the speed of disinflation does have a negligible effect on high inflation sacrifice ratio, while trade openness is observed to have a highly negative but significant impact.

In another study that looked at the impact of trade openness and the degree of capital mobility on the sacrifice ratio, Daniels & VanHoose (2007), empirically evaluated the significance of a theoretical model of an open economy in which variations in both capital mobility and trade openness can influence the scarifice ratio; they concluded that either form of globalization can independently affect the sacrifice ratio, when the level of central bank independence and the level of wage stickiness in an economy are taken into consideration.

3. Data and Econometric Methods

3.1 Data Collection and Transformation

For this study, Gross Domestic Product (GDP), Inflation (headline and core data), broad money and narrow money were obtained from Central bank of Nigeria (CBN) and NBS. Nigeria's GNP series was in billions and in national currency. To obtain the GNP series' potential and actual values difference, we adopt Hodrick Prescott Filter (using HP Filter (λ=1600 for quarterly data). The obtained Hodrick Prescott Filter trend value allows us to obtain the gap, actual output is at its tr-

end level and potential GDP growth. The output gap has been estimated as:

$$\text{outputgap(yg)} = \log(\text{Actualoutput(y)}) - \log(\textit{potentialoutput}(yp)) \quad 1$$

Table1.0: Summary Statistics of Some Selected Macroeconomic Variable

	CORE	HEADLINE	FOOD	CGDP	RGDP	M1	M2
Mean	11.77411	11.74643	11.67768	7903174.	6.770179	4747715.	10322234
Median	10.85000	11.25000	11.40000	6397039.	7.125000	4942222.	10813063
Maximum	36.30000	24.30000	29.50000	18533752	10.77000	11404906	23725132
Minimum	0.500000	4.100000	-0.800000	114617.6	-2.240000	1121550.	1918926.
Std. Dev.	7.052461	4.472360	5.401509	7902593.	2.908934	2660029.	6503344.
Skewness	1.680180	0.919821	0.367559	0.059160	-1.592119	0.188318	0.216397
Kurtosis	6.721875	3.667545	4.545326	1.078882	5.600868	2.200235	1.864009
Jarque-Bera	58.67021	8.936424	6.833006	8.644286	39.44241	1.823451	3.448167
Probability	0.000000	0.011468	0.032827	0.013271	0.000000	0.401830	0.178336
Sum	659.3500	657.8000	653.9500	4.43E+08	379.1300	2.66E+08	5.78E+08
Sum Sq. Dev.	2735.546	1100.110	1604.696	3.43E+15	465.4043	3.89E+14	2.33E+15
Observations	56	56	56	56	56	56	56

Fig 1.0:Trends in Infllation and Real GDP growth (2003 - 2016)

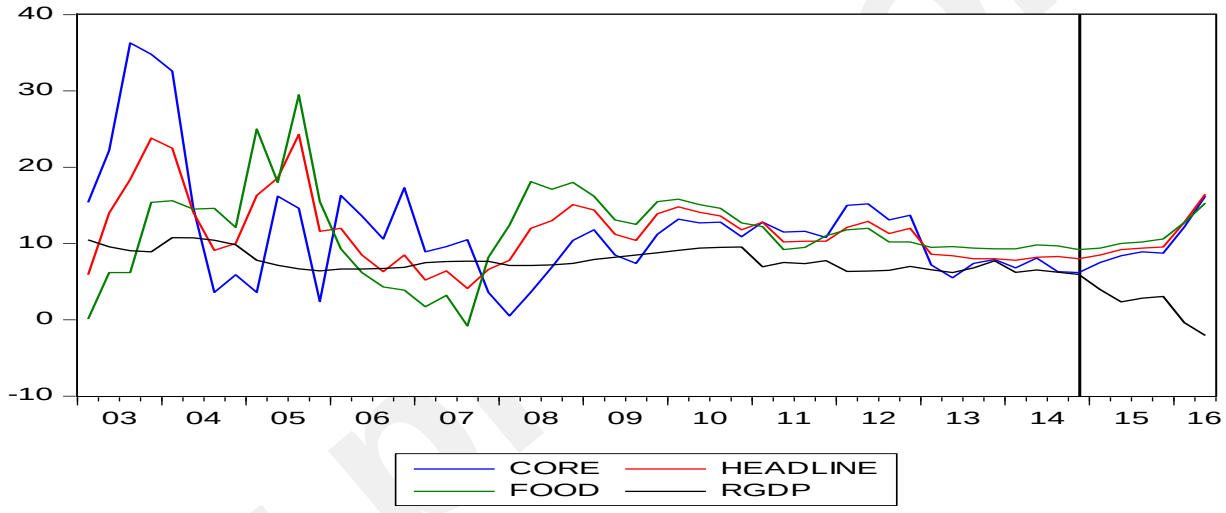
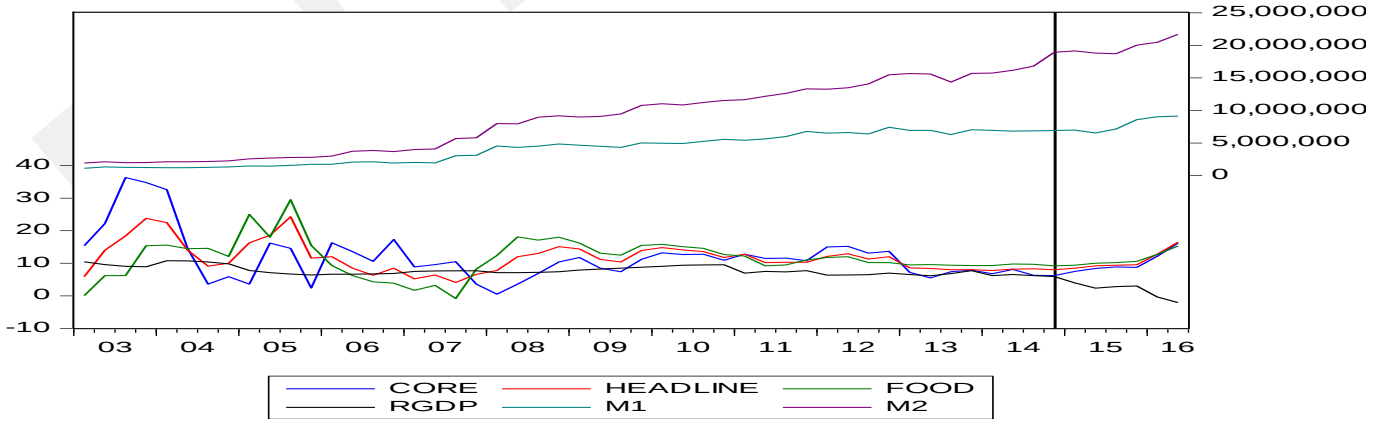


Fig 2.0:Trends in Infllation and Real GDP growth (2003 - 2016)



We further consider relevant descriptive statistics and formal pre-tests in order to evaluate the statistical properties of the series we are dealing with. Table 1 provides all the relevant preliminary analyses. The descriptive statistics cover the mean, standard deviation as well as the distribution properties on the basis of skewness and kurtosis. The Jarque-bera values indicate that the variables are not normally distributed. To further investigate the structural breaks in the trend in

real GDP equation, Quandt-Andrews breakpoint tests have been applied. Table 2 presents the structural break tests. The tests conclude that there are no significant structural changes. Figures 1 and 2 are the graphical representation of the developments in inflation, real GDP and Money stocks in Nigeria for the period 2003Q1 and 2016Q4.

Table 2: Structural Break Tests

Statistic	Value	Prob.
Maximum LR F-statistic (2013Q3)	9.219744	0.0001
Maximum Wald F-statistic (2013Q3)	27.65923	0.0001
Exp LR F-statistic	2.534500	0.0033
Exp Wald F-statistic	10.70254	0.0005
Ave LR F-statistic	3.239309	0.0034
Ave Wald F-statistic	9.717928	0.0034

Note: probabilities calculated using Hansen's (1997) method

3.2. Theoretical Model and Hypothesis

The relation between potential real GDP used and actual real GDP difference between quarter's inflation rate series is relation coefficient; which is the sacrifice ratio. The coefficients calculation will be composed of two different methods. The first method will include a regression equation which will provide a ratio. This method does not include between period changes and includes a single constant change coefficient; therefore the method is heavily criticized. Other approach includes a approach where a different ratio can be calculated for each year individually as a series. For this study both methods will be adopted and individually be calculated. After evaluating sacrifice ratio, within the disinflation periods disinflation periods monetary policy affects sustainability will be measured with "hysteresis coefficient". Relevant literature reflects that, sacrifice ratio measurements have been linked with expectations backed Phillips Curve approach. This paper would also rely on the adaptive expectations Augmented Phillips Curve approach to measuring sacrifice ratio. In the corresponding equation, output has been associated with GDP or between GNP and inflation [Okun 1978, Gordon and King 1982].

$$y_t - y_t^* = \alpha(\pi_t - \pi_{t-1}) + e_t \;\; \alpha \succ 0 \qquad 2$$

On the first equation y_t = actual output level, y_t^* = Potential output level, π_t = t periods actual inflation rate and $\pi_t - \pi_{t-1} = t$ periods actual disinflation rate and represents the error term. Within the equation the sacrifice ratio is defined by α, the conducted regression analysis result can be accepted as a stable value. The sacrifice ratio is expected to be positive. Meaning of this expectation is that, dis-inflationist periods in-between inflation rate increase $\pi_t - \pi_{t-1} = t$, is increasing the difference between actual and potential difference $y_t - y_t^*$. To elaborate more, if the in between two period inflation rate was dropping caused by disinflation policies, due to the actual shrinkage experienced within the economy actual output dropping, the gap between potential and actual inflation will raise which is defined as the output gap. As a result, the defined rate of sacrifice is the output reduction to reduce the inflation rate one score. The higher the in-between periods inflation rate is the higher will be the output gap.

Within this framework, [Ball 1994], assumes a variable sacrifice ratio while the basic model assumes the ratio to be constant, Ball argues that,

as the inflation rate increases or drastic fluctuations in demand occurs, keeping the sacrifice ratio constant will not be very reliable. In equality 2, nominator is the quarterly output gap and the denominator is the quarterly differences in the inflation rate:

$$SR = \sum (y_t - y_t^*) / (\pi_t - \pi_{t-1}) \quad 3$$

Here the model associates the output gap in the dis-inflationist times, with the inflation rate decline in the corresponding time period $\pi_t - \pi_{t-1}$. In this method, sacrifice ratio will be turned into a series where the trend can be observed (Jordan 1997, Bernanke et al. 1999, Boschen and Weise 2001), Ball specially preferred this model with respect to previous ones.

Although Ball solves this problem by selecting annually changing sacrifice ratios and adapting these ratios for every corresponding year, and thus solving the problem of keeping sacrifice ratios constant [Ball 1994], Zhang arguing that sacrifice ratio changing annually and keeping a structure will make the Ball's approach inadequate [Zhang 2001]. For him not only the sacrifice ratio but impact intensity as a result of change process is as well important. To remove such bottlenecks below mentioned equation (3) has been used at the implementation stage:

$$y_t - y_t^* = \alpha(\pi_t - \pi_{t-1}) + \beta(y_{t-1} - y_{t-1}^*) + e_t \quad \alpha \succ 0, 0 < \beta < 1 \quad 4$$

Here β coefficient shows the power of persistence effect. As β, goes to 1'e the degree of persistence effect will also increase. On the contrary Zhang, assumes the value of β is between 0 < β < 1.

As in the case of Zhang [2001], similar findings by Çetinkaya and Yavuz [2002] show that, disinflation phase as a result of monetary shocks, will correspond to a long lasting impacts. And these findings are backed up by long term impacts. In both studies, Ball [1994] and Zhang [2001] observed very strong persistence effect, which they named it as hysteresis impact. If the hysterical attitudes influence the output via monetary policy, disinflation permanent impact will be realized [Zhang 2001].

4. Empirical Result

4.1 Unit root tests

The paper adopted three unit roots in order to determine the order of integration of the variables. Table 1a and 1b reports the summary statistics and correlations. Tables 1 and 3 report the univariate unit root test results. These series are integrated at I (1), when constant a trend were use. (see Table 3).

Table 3: Unit root test (ADF and PP test)

Variable	Level		1st Difference	
	ADF	PP	ADF	PP
Include a constant only				
Rgdp	-0.2099		- 6.1997*	-6.1557*
Headline	-2.8992**	-3.3418**	-2.8992**	-8.3109*
Core	-3.3544*	-2.9636**	-7.3798 *	-7.2723*
Cgdp	-0.7332	-0.7305	-7.3449*	-7.3476*
M1	1.1981	1.3635	-7.0459*	-7.0446*
M2	1.5799	2.6518**	-7.5915 *	-7.5947*
Include both the constant and trend				
Rgdp	- 0.8281***	-0.9662	-6.3306 *	-6.2383*
Headline	- 2.9679**	-8.3109*	- 2.9679**	-11.2163*

Core	-3.0982**		-3.1320**	- 8.1841*		-7.6163*
Cgdp	-2.1343		-2.1770	-7.2768*		-7.2774*
M1	-1.4442		-1.4442	-7.3353*		-7.3352*
M2	-2.2595		-1.9850	-8.1026*		-8.2452*
	Constant only			Constant and trend		
Critical value	1%*	5%**	10%***	1%*	5%**	10%***
ADF	-3.5550	-2.9155	- 2.5956	-4.1372	-3.9452	-3.1766
PP	-3.5557	-2.9166	- 2.5961	-4.1372	-3.9452	-3.1766

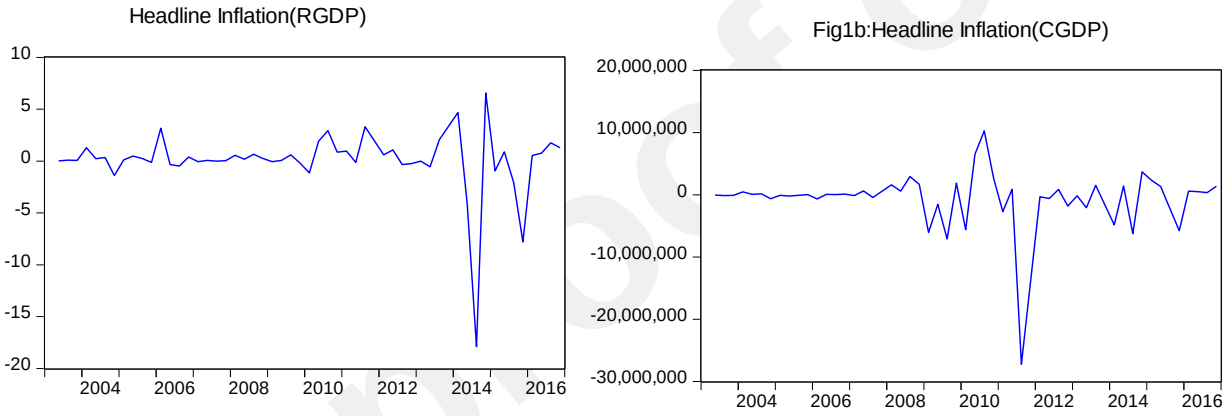
4.2 Analysis of Sacrifice Ratio Estimates

To calculate the initial sacrifice ratio [Ball 1994] approach has been adapted. This method aims to reach to general sacrifice ratios by calculating sacrifice ratios:

$$SR = \sum (y_t - y_t^*) / (\pi_t - \pi_{t-1}) \qquad 5$$

Figure 3 shows the sacrifice ratio trend for the headline inflation and core derived from the equation 5, for the given years:

Figure 3



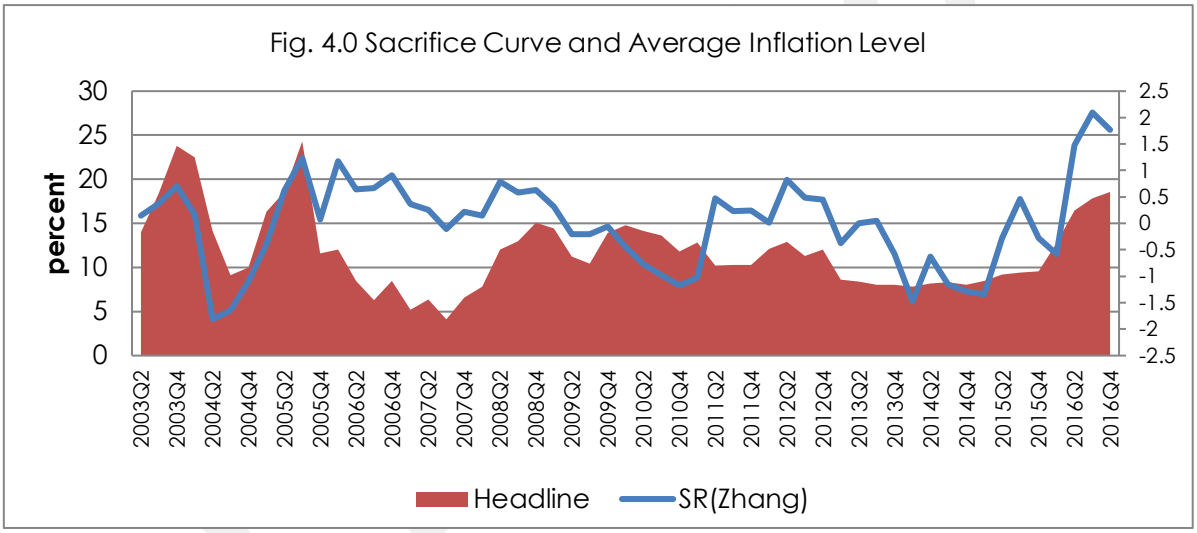
As can be seen from the graphs (Figure 1a and 1b) over the years sacrifice ratio (using headline inflation for cgdp and rgdp) generally seems stable while on some periods certain low and peaks can be observed. In the year 2010 –2012, late 2014 and early 2015 the sacrifice ratio seems to drop while on mid-2015 and 2016 there are high peaks experienced.

Table 4: Regression Results

$y_t - y_t^*$	Coefficient (Sacrifice Ratio) (α)	Coefficient(Persistence Ratio)(β)	LM TEST	BPG
Model I	0.08	-	25.367	4.828
	(0.08)		(0.000)	(0.032)
Model II	0.076	-0.707	0.672	0.695
	(0.02)	(0.00)	(0.515)	(0.504)

In the second phase of our research, OLS regression has been structured for $y_t - y_t^*$ as the dependent variable and inflation difference ($\pi_t - \pi_{t-1}$) as the independent variable. In Model II independent factors inflation difference ($\pi_t - \pi_{t-1}$) and output gap ($y_{t-1} - y_{t-1}^*$) has been inserted to the model with a difference variable. Both functions have been estimated by OLS regression. The sacrifice ratio for both models I and II are positive. The estimates α in both functions give us the sacrifice ratio, while the β in model 2 reflects the power of persistence effect (Direkçi 2011). Unlike in model 1, model 2 sacrifice ratio α and the persistent effects (β) are statistically significant and satisfy the Breusch-Godfrey Serial Correlation (LM) Test and Breusch-Pagan-Godfrey (BPG) test. This means that, increase in inflation rates (headline), increases the output gap (rgdp). The sacrifice ratio measures how much output is lost when inflation goes down by 1%. The outcomes of our study suggest that a 1 percent disinflation achievement bring out output falls by 0.07%. This could help the Bank decide what to do about its monetary policy, in terms of stimulating or slowing down growth. While the power of persistence effect is statistically significant and permanent, inflation effect exists; as (β) approaches one, power of persistence effect increases. For the given period power of persistence effect coefficient is 0.71 on the average. This finding suggests that, disinflation policies have a stronger and long lasting impact on the real GDP.

Fig. 4.0 Sacrifice Curve and Average Inflation Level



The estimates have been plotted against the time to get a sacrifice curve. In our paper, the sacrifice curve thus obtained indicates that the sacrifice ratio estimates remained low are 2004, 2010, 2013 and 2014. However the sacrifice ratio estimates have been found to be increasing from 2015 which continued till 2016. Also, during the global crisis and recession of 2016, the sacrifice ratio has been found to be increasing again gradually early 2017. Thus, the study suggests the need for caution as the bank implement its tradeoff between inflation and growth.

6. Conclusions

This study sets out to estimate the sacrifice ratio of inflation conducive for growth in Nigeria. This study aims to test whether for the 2003 - 2016 period monetary policies which reduced the ongoing inflation to one digit rates, also led to output losses in Nigeria for the same time period. Using the conventional model of sacrifice ratio model two sets of functions were estimated by OLS regression. The sacrifice ratio for both models I and II are positive. The estimates α in both functions give us the sacrifice ratio, while in the second model β in model 2 reflects the power of persistence effect (Direkçi 2011). Unlike in model 1, model 2 sacrifice ratio α and the persistent effects (β) are statistically significant satisfy the Breusch-Godfrey Serial Correlation (LM)

Test and Breusch-Pagan-Godfrey (BPG) test. This means that, increase in inflation rates (headline), increases the output gap (rgdp). The sacrifice ratio measures how much output is lost when inflation goes down by 1%. The outcomes of our study suggest that a 1 percent disinflation achievement bring out output falls by 0.07%. This helps can the Bank decide what to do about their monetary policies, which can stimulate or slow down growth.

While the power of persistence effect is statistically significant and permanent, inflation effect exists, as β approaches unity, and power of persistence effect increases. For the given period, power of persistence effect coefficient is 0.71 on the average. This finding suggests that, disinflation policy has a stronger and long lasting impact on the real GDP.

The estimates have been plotted against the time to get a sacrifice curve. In our paper, the sacrifice curve obtained thus indicates that the sacrifice ratio estimates remained low in 2004, 2010, 2013 and 2014. However the sacrifice ratio estimates have been found to be increasing from 2015 which continued till 2016. Also, during the global crisis and recession of 2016, the sacrifice ratio has been found to be increasing again gradually into early 2017. Thus, the study suggests the need for caution as the bank implements its tradeoff between inflation and growth.

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