Sacrifice Ratio: An Empirical Analysis of the Nigerian Economy

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Abstract

This study empirically analsed the sacrifice ratio in Nigerian economy. The Ball (1994) method was utilized, according to the method, 9 disinflation episodes were identified. The results obtained revealed sacrifice ratios of -0.208%, 0.379%, 0.430% and 1.399% for each of the 1973-1974, 1984-1987, 1993-1997 and 2012-2013 disinflation episodes respectively, resulting in average sacrifice ratio of 0.635% for Nigeria. This means that the output and unemployment cost of disinflation in Nigeria are 0.635 and 0.318 percent respectively, meaning that the percentage of a year's real GDP and employment that must be forgone to reduce inflation by 1 percentage point in Nigeria is 0.635 and 0.318 respectively. It was also revealed that output and unemployment adjusts to inflation rate changes in Nigeria. Based on these findings, the study recommends that the cold-turkey approach to inflation reduction should be encouraged given the fact that Nigeria being a developing nation facing stagflation, with a low output and unemployment cost of disinflation and a high inflation rate needs to drastically reduce her inflation rate to be moderate enough to stimulate investment and grow the economy in order to address her basic problems of stagflation. The monetary authority should also make the creditability of inflation reduction policy a priority. In this way, disinflation can be achieved without significant reduction in output and employment. An apt change in policy could create public confidence and monetary policy credibility.

Keywords: Sacrifice ratio, Disinflation, and Monetary policy

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Background to the Study

The main macroeconomic objectives of most nations include the attainment of economic growth, price stability, high levels of employment and balance of payments equilibrium. From these objectives, most nations give priority to economic growth and price stability because of their influences on other macroeconomic variables. Studies have revealed that price stability fosters economic growth; this suggests that a high level of inflation is capable of undermining practical efforts at actualizing economic growth and other macroeconomic objectives. Some studies suggest that a zero level of inflation is a disincentive to growth. Hence, inflation policy is an important macroeconomic policy of any monetary authority (Morar, 2011).

A common approach to measure the output and unemployment cost of disinflation is the estimation of the sacrifice ratio. The sacrifice ratio is based on the fact that given the potential output level, any reduction of inflation leads to an increase in unemployment with a corresponding reduction in output at the current period. A high sacrifice ratio means a large loss of real GDP for a given reduction in inflation (disinflation), while a low sacrifice ratio signifies a small loss of output for disinflation (Coffinet, et al., 2007; Cecchetti & Rich, 2001; Mazumder, 2012). The choice of the right policy to be pursued has made some Policy makers to be inflation averse and others unemployment averse depending on the prevailing economic situation in their economy at the time (level of inflation and unemployment) or their country's state of development. For instance, an inflation averse administration is always opposed to increasing the inflation rate to a higher level while the unemployment averse administration on the other hand, is always opposed to increasing the unemployment rate to a higher level.

There is a common notion that the size of the sacrifice ratio depends on how inflation rate is reduced. Thus inflation reduction and the output cost of disinflation have generated two groups of economists. The first group has focused on the speed of disinflation. This group is further divided into the rapid (or cold-turkey) disinflation and the moderate disinflation views. The cold-turkey view suggests that monetary authority should adopt a rapid or a "cold turkey" approach to inflation reduction. The supporters of the cold turkey approach believed that gradualism raises the probability of future reversals and may have no favourable impact on inflationary expectations. On this basis, the cold turkey approach is less costly because inflation expectations adjust sharply and therefore preferable. The supporters of gradualism, on the other hand, pointed out that wages and prices, which exhibit persistence behaviour, can adjust smoothly to tighter monetary policy, thus moderate disinflation is preferable (Kinful, 2007).

These inflation reductions impose cost to the economy in terms of output lost. Several studies (Belke & Böing, 2014; Dramani & Thiam, 2012; Daniels & VanHoose, 2004; Cecchetti & Rich, 2001; Muñoz-Torres et al., 2004) have succulently demonstrated that the sacrifice ratio differs considerably among countries, yet this is uncertain for Nigeria. As further enunciated by Daniels & VanHoose, (2004) and Dramani & Thiam, (2012), it is possible to reduce the size of the sacrifice ratio without a corresponding increase in the rate of inflation,

if the policymakers can manage the people's expectations credibly. This has made this study to ascertain what Nigeria's sacrifice ratio could be after many successful inflation reductions over the years. In Nigeria, there are issues relating to inflation-output relationship, among which are the actual size of sacrifice ratio for Nigeria, the actual output and unemployment cost of inflation reduction and the impact of output and unemployment on inflation rate changes, which are under-researched in Nigeria. This study differs from existing studies by empirically studying the actual size of the sacrifice ratio in Nigeria and also finds out the extent to which output and unemployment adjusts to inflation rate changes in Nigeria. Therefore, this paper is structured along different sections. This section is the introduction. Section two reviews literature related to the study, section three presents the methodology of the study, while section four presents analysis and interpretation and section five concludes the paper.

Literature Review and Theoretical Framework
This section reviews the literature on the concept of sacrifice ratio, empirical reviews, some related theories and theoretical framework.

Concept of Sacrifice Ratio
The sacrifice ratio according to Serju (2009) measures the quantity of output that is lost for each percentage point reduction in the inflation rate. Cecchetti & Rich (2001) in their study defined the sacrifice ratio as the cumulative loss in output, measured as a percent of one year's gross domestic product (GDP), resulting from a one-percentage-point permanent reduction in inflation. A similar definition is given by Dornbusch et al. (2008) and Abel et al. (2008). According to them, the sacrifice ratio is the percentage of output lost for each one point reduction in the inflation rate. The sacrifice ratio is an extension from the Phillips curve, which states that an inverse relationship exists between inflation and unemployment in the absence of a supply shock. This unemployment relates to output because high unemployment connotes low output and vice versa. The Phillips curve technically looks at the relationship that exists between inflation and unemployment. On the other hand, sacrifice ratio specifically looks at the relationship that exists between inflation and output. It entails the trade off that exists between inflation reduction and output/employment lost in the attempt to reduce the level of inflation. Hence, it is called the output and unemployment cost of disinflation. It can be defined as the quantity of output and employment that is given up in order to reduce the inflation level by one percent in the current period. Just like the concept of opportunity cost, it looks at the quantity of output and unemployment to be forgone for one percentage point reduction in the inflation rate in the short run.

Stylized Facts
In Nigeria, the CBN has over the years adopted tight monetary policy to reduce the inflation rate. Periods in which the monetary policy was tightened include 2008, 2010, 2012, 2014 and 2016. In 2008, the Monetary Policy Rate (MPR) was reviewed twice in the second quarter, owing to inflationary pressure. The tight monetary policy was coupled with the global credit crunch in late 2008. In 2010, the CBN adopted tight monetary policy. The MPR was reviewed upwards six times during the year, in line with the liquidity conditions. Interest rates were

generally higher than in the preceding year. Another tight monetary policy stance was maintained in 2012. The periods 2013-2016 was also characterized by constant review of the MPR partially due to the effect of the 2015 general election. Growth in money supply was modest, reflecting the tight monetary policy stance. Money supply (M_2) was below the indicative growth benchmark of 24.6 percent to 15.4 percent (CBN, 2015).

A look at the records revealed that inflationary pressures reduced substantially after the adoption of disinflation measures. For example, Nigeria succeeded in achieving a single digit inflation rate of 9.5%, 6.2%, 6.9%, 9.7% and 3.6% in 1975, 1978, 1982, 1987 and 1990 respectively. Also, a single digit of 8.6% was recorded in 2006. Inflation was reduced by 48.65% from 1973-1974, 54.07% reduction was achieved between the periods 1975-1978, again, the inflation rate was reduced by 60.34% during the periods 1981-1982, it was reduced by 57.08% for the periods 1984-1987, 75.51.8% for the periods 1989-1990 and 25.86% for the periods 2005-2006 (CBN, 2012). More so, Nigeria also recorded single digit inflation rates of 8.5% in 2013. Also, 43.71% reduction was achieved between the periods 2008-2013 (CBN, 2016).

Measures of Estimating the Sacrifice Ratio
According to Durham (2001), in his work on Sacrifice Ratio and Monetary Policy Credibility, he identified different measures of estimating sacrifice ratio, which include the following:

The Phillips Curve Approach
The first method which is the (augmented-expectation) Phillips curve approach captures the trade-off between inflation and output over a given period of time by index. A variant of this method considers a time-varying measure which calculates the trade-off for each episode.

Under this approach, the sacrifice ratio is calculated as;

$$SR = \Delta Y / \Delta \Pi \qquad \qquad (1)$$

Where, SR = Sacrifice ratio
$\qquad$ Y = Real aggregate output
$\qquad$ Π = Inflation rate.

The Ball (1994) Approach
This method was developed by Ball (1994). It prescribes two ways of calculating sacrifice ratio; one using quarterly data and the other using annual data. The formula under this method is as follows:

$$SR = [\textstyle\sum_{t=s}^{E+4}(y_t - y_t^*)] / (\pi_t - \pi_{t-1}) \qquad \qquad (2)$$

Where SR = Sacrifice ratio
$(y_t - y_t^*)$ = Sum of output losses over the disinflation period
$(\pi_t - \pi_{t-1})$ = Change in inflation trend

Year t is an inflation peak (trough), if inflation at t is higher than (lower) than inflation at t+1 or t-1, that is troughs and peaks are defined with reference to a year on both sides. Trend output can be calculated by connecting output at an inflation peak to output one year after the trough. The sum of the differences between the various levels of actual output throughout the episode (inclusive of the output one year after the inflation trough) and output at the inflation peak, gives the output loss for each episode. The output values are to be logged as prescribed by Ball (1994).

The formula specified above is guided by the following assumptions:
   a) The natural level of output is at the start of a disinflation episode.
   b) Output returns to its potential level four quarters after the end of an episode i.e, four quarters after an inflation trough. In terms of annual data, output returns to its potential level one year after an inflation trough.
   c) Potential output grows log-linearly between two points when actual and potential outputs are equivalent.

Mankiw (2010) Approach
Mankiw (2010) also advanced a measure for the sacrifice ratio during an inflation episode. The formula is given as;

$$SR = \Delta Y_e / \Delta I_e \qquad\qquad (3)$$

Where, SR = Sacrifice ratio
ΔY_e = Loss in GDP over the disinflation period
ΔI_e = Change in inflation trend.

Of the three measures reviewed, the Phillips curve and the Ball (1994) approaches will be adopted in this work. The Phillips curve approach was adopted because of its robustness. The Phillips curve approach is more scientifically inclined to produce a realistic and dependable result unlike the other methods. The Ball (1994) approach on the other hand was also adopted for the purpose of re-calculating the sacrifice ratio because it is the most widely recognized method of estimating sacrifice ratio.

Empirical Review
This section reviews relevant related empirical studies. Many foreign studies as well as studies specific to Nigeria have been carried out on the subject matter. For example, Kabundi (2016) estimates the sacrifice ratio for the South African economy using quarterly data of annual inflation and unemployment rate from 1994Q4 TO 2014Q4. He used the Time-Varying Phillips curve. The result shows that the average sacrifice ratio for South Africa is 1.5, also shows that the time varying sacrifice ratio depends on the slope of the Phillips curve and the inflation persistence. Bashiri & Amirkhiz (2015) examined sacrifice ratio and disinflation cost for selected OPEC countries: panel data evidence for the period 1990-2013. Applying panel cointegration and dynamic ordinary least squares (DOLS) methods, results showed that there are positive relationship between inflation change with sacrifice ratio and negative relationship between initial inflation and openness with sacrifice ratio. Meaning that cost of

disinflation reduced up to 8% by increasing in openness and this value for inflation rate changes, causes 11% sacrifice ratio change. Belke & Böing (2014) applying a structural vector autoregressive technique, found that most countries had sacrifice ratios of between 1 and 2 per cent of real GDP for a reduction in inflation of one percentage point. In some cases, these estimates deliver negative sacrifice ratios.

Dholakia (2014) estimated the sacrifice ratio and cost of inflation for the Indian economy. He found that the sacrifice ratio in India turns out to be in a narrow range of 1.8 to 2.1 for deliberate deflation and 2.8 for inflation. On the other hand, benefits of one percentage point reduction in trend rate of inflation were at best 0.5 percentage points increase in long-term growth of output that occurs after 4-5 years. Daniels & Van Hoose (2013) studied the relationship between exchange-rate pass through, openness, and the sacrifice ratio. The authors found that greater pass through increases the sacrifice ratio, that there was significant interaction among pass through and openness, and once the extent of pass through was taken into account alongside other factors that affected the sacrifice ratio, such as central bank independence openness exerts an empirically ambiguous effect on the sacrifice ratio.

The study of Gozgor (2013) focused on the NKPC for the Turkish economy over a period of implicit and explicit inflation targeting monetary policy. The author used Generalized Methods of Moments (GMM) as his method of estimation. The study found that in the Turkish economy, NKPC was consistent with the theoretical background and the parameter restrictions were satisfied. Liao & Hu (2013) examined the influencing factors of inflation persistence in China's economy using the DSGE approach. The authors found that inflation persistence mainly came from the persistence of the money supply, while money supply uncertainty, the reaction coefficient of monetary growth to productivity, productivity persistence and productivity uncertainty had a smaller impact on inflation persistence. On the other hand, changes of monetary policy were found to have little effect on inflation persistence.

The study of Ascari & Ropele (2012) compared the effects of disinflations of different speed and timing, implemented through either a money supply or an interest rate rule. The authors found that in terms of transitional output loss, cold-turkey disinflations under an interest rate rule were less costly than those under a money supply rule and are accomplished more rapidly. Again, added that gradual or anticipated disinflations deliver lower sacrifice ratios. Dramani & Thiam (2012) calculated the sacrifice ratio for countries in West African Economic and Monetary Union (WAEMU). Their findings showed that sustained decline of 1% inflation rate inherent in a monetary shock leads to a cumulative decline of 1.3% growth rate in Senegal, and 0.06% in Benin.

Evans & Nicolae (2012) focused on the relative impact of the main drivers of the sacrifice ratio, initial inflation, speed of disinflation and imperfect credibility. Their findings revealed that 75% of the sacrifice ratio was attributable to the initial inflation rate, 14% to the initial lack of credibility and 11% to the speed of disinflation. Their conclusion was that, for the

range of inflation rates considered, what matters most for the sacrifice ratio was the scale of the disinflation, followed by the degree of credibility and the speed of disinflation.

Mazumder (2012) measured the sacrifice ratio for all countries of the world (OECD and non-OECD); using a sample of 189 countries with data spanning from 1964-2009 (40 years), also exploring the determinants of the sacrifice ratio. He adopted the Ball (1994) methodology in his study. His findings suggest that the speed of disinflation is the major determinant of sacrifice ratio value but having insignificant effect on non-OECD countries' disinflation cost. Greater central bank independence and openness are responsible for lower ratios in non-OECD countries. He estimated -0.4 as the sacrifice ratio for Nigeria for the period 2004-2007.

Coffinet et al. (2007) used three methods to estimate the sacrifice ratio for the euro area: an ad hoc method, a structural VAR approach and a general equilibrium model, covering the first quarter of 1985 to the fourth quarter of 2004. The authors estimated the sacrifice ratio to be at between 1.2 and 1.4%; implying that the short-term cost of a 1 percentage point permanent decline in inflation was over 1 GDP point.

Kinful (2007) applied all the three known methods within the economic literature to estimate the size of the sacrifice ratio for Ghana. It was found that the estimated sacrifice ratios indicated that in Ghana a permanent 1 per cent drop in inflation results in an output loss within the range of 0.001 to 5.1 per cent. The author concluded from the study that if a disinflation process persists and policies are consistent and credible, the economy may eventually adjust to the new monetary policy regime and output and employment losses may only be transitory.

In like manner with the foreign studies reviewed above, relevant related studies specific to Nigeria have also been carried out. Edeme et al. (2018) analyzed the impact of Inflation reduction on output and unemployment in Nigeria. They adopt the Instrumental Variables Generalized Method of Moment (IV-GMM) technique and using data from 1970-2015. Their findings suggest that inflation inertia has a significant negative impact on the actual rate of inflation in Nigeria. It was also revealed that the percentage of a year's real GDP that must be forgone to reduce inflation by 1 percent in Nigeria is 5.1 percent while 53.6 percent of output was sacrificed in 1982. Equivalently, a sacrifice ratio of 26.6 percent of unemployment was made in the same year, while the highest percentage of GDP was sacrificed in 1990 and the lowest in 2007.

Sanusi (2015) estimated an inclusive growth cost of disinflation in Nigeria for the period 1960:1 –2015:2 and determined the influence of central bank independence on the sacrifice ratio. He employed two approaches to estimate the sacrifice ratio viz.; a variant of the Ball (1994) approach and the Phillips curve approach. He found out that disinflation is costless post-central bank independence and that the inclusive growth sacrifice ratio are very small and nearly non-existent. His results however indicated output cost ranging from -0.16-0.46, with negative values in the recent episodes. Fontana & Ononugbo (2013) analyzed the nature

of a new Keynesian type Phillips curve in Nigeria and the implication of disinflationary monetary policy. Their results indicate that, contrary to the postulations of the new Keynesian, the long-run PC is not vertical but somewhat horizontal – with a slight negative slope. The nature of the Phillips curve according to the authors suggested a considerable cost of disinflationary monetary policy.

Chinaemerem & Akujuobi (2012) examined whether or not one of the preconditions for a successful inflation targeting framework is present in Nigeria and Ghana. In achieving this objective, three VAR models were estimated by the authors starting with a two-variable model including money supply and prices, and then, adding some financial variables such as nominal exchange rate and interest rates in order to see their contribution to a VAR system for Nigeria and Ghana. It was concluded that policy linkage between inflation and monetary policy instruments in Nigeria and Ghana were not strong in the short run and thus, these countries were not yet candidates for inflation targeting. Umaru &Z ubairu (2012) investigated the relationship between unemployment and inflation in the Nigerian economy between 1977 and 2009. They applied Augmented Dickey-Fuller techniques, Granger causality test, cointegration test, and ARCH and GARCH technique. The results of their study revealed that inflation impacted negatively on unemployment. The causality test also revealed that there was no causation between unemployment and inflation in Nigeria during the period of study and a long-run relationship existed between them cointegration test. It was further pointed out that there was a high volatility clustering among the variables.

Bakare (2011) examined the trade-off between inflation and economic growth in Nigeria using the Philips relation approach. The author found that there was a positive relationship between inflation and output growth in Nigeria. It indicated that a 1 percent rise in inflation in current period leads to 6.4 percent increase in output. Adebayo (2010) estimated a small scale macro-econometric model for Nigeria using a dynamic stochastic general equilibrium approach. He estimated an output gap of 0.306 and arrived at a sacrifice ratio of 1.306 using the Phillips curve approach. Findings suggest that the previous rate of inflation has a stronger influence on the current rate of inflation than the expected future rate.

Theoretical Framework
The modern Phillip's curve and Okun's law provided theoretical framework for the study. Hence, the theories are briefly reviewed.

The Modern Phillip's Curve
The relationship between inflation and unemployment has been explained by different scholars at different times. One of these analyses is the modern Phillips curve propounded by Friedman and Phelps in 1970. The modern Phillips curve is a widely used structural model of inflation dynamics (Gali et al., 2005). They analyze a situation of trade-off between inflation and unemployment as temporary and occurs only in the short run while in the long run, the Phillips curve is vertical at the natural rate of unemployment also known as NAIRU (Non Accelerating Inflation Rate of Unemployment) (Colander, 2006). Friedman was able to explain that the Phillips curve is vertical in the long run and may have a negative slope in the

short run and why the short run Phillips curve might shift using the concept of policy surprises. See graph:

Figure 1: The Modern Phillips curve
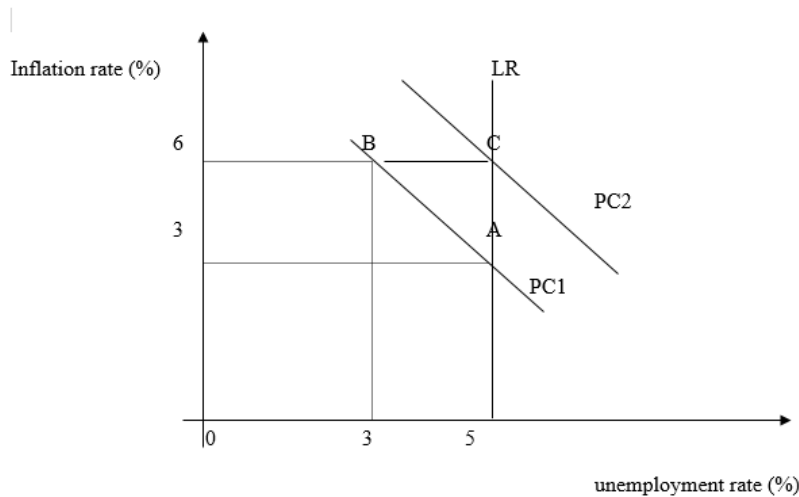
At point A on the long run Phillips curve LR, the economy is at equilibrium at the prevailing inflation rate of 3% and natural rate of unemployment of 5%. If the policy direction aims at reducing the level of unemployment by increasing aggregate demand, the policy makers would move the economy from point A to point B on the short run Phillips curve PC1. At point B, the inflation rate has increased to 6% while the unemployment rate fell to 3% (Colander, 2006).

However, in the long run, workers are expected to notice depletion of their real wages which would initiate negotiations to increase their wages in order to adjust their expectations of inflation from 3% to 6%. This leads to an increase in wages which raises firms' cost of production thereby reducing their profits. Firms in return reduce output and employment to maintain their profit level which eventually increases the unemployment rate. This is shown in figure 2.2 by movement from point B on short run Phillips curve PC1 to point C on the short run Phillips curve PC2. If the aggregate demand is maintained at the current level, the economy will be stabilized at 6% rate of inflation and unemployment will fall back to the 5% natural rate of unemployment since it is the result of both workers' expectation of inflation and the actual inflation. Therefore, in the long run, inflation and unemployment have undergone all the necessary adjustments resulting in a vertical Phillips curve at the natural rate of unemployment (Colander, 2006).

The Okun's Law
Arthur Melvin Okun propounded the theory in his 1962 article to explain the relationship that exist between unemployment and output losses or the relationship between unemployment and output gap. The law stated by Okun was in two versions, the difference version and the gap version.

Abel and Bernanke (2005), specified the gap version of Okun's law as follows:

$$\tilde{Y}\text{-}Y/\tilde{Y}= C(U\text{-}\bar{U}) \qquad (4)$$

Where; $\tilde{Y}$= Potenial GDP

Y= Actual GDP

$\bar{U}$= Natural rate of unemployment

U= Actual unemployment rate

C= Is a factor relating changes in unemployment to changes in output, which has been around 2 percent and 3 percent since 1955.

This measure is rarely used due to the difficulty in computing $\tilde{Y}$ and $\bar{U}$ which can only be estimated.

The difference version on the other hand is expressed as follows:

$$\Delta Y/Y = K - c\Delta U \qquad (5)$$

Where; ΔY= Change in actual output from one year to the next

ΔU= Change in unemployment from one year to the next

K= Average annual growth rate of full employment output.

In his postulation, Arthur Okun stated that 1percent increase in the growth rate above the trend rate of growth (or the growth in potential output) would lead only to 3percent in the reduction of unemployment. In other words, a 1 percent increase in unemployment will mean roughly more than 3 percent loss in GDP growth (Knotek, 2007).

The current version of the law, which has been adjusted to reflect current economic conditions and employment trend states that; for every 2 percent that GDP falls relative to potential GDP, the unemployment rate rises by about 1 percent point (Samuelson & Nordhause, 2001).

Frank & Bernanke (2001), states the law as follows; each extra percentage point of cyclical unemployment is associated with about a 2 percent point increase in the output gap, measured in relation to potential output. This means that if unemployment and output losses were initially at 1 percent and 2 percent respectively, an increase in unemployment from 1 percent to 2 percent, will lead to an increase in output losses from 2 percent to 4 percent. This is because a fall in output results in fewer workers needed by firms, so no new workers are employed and current workers are laid off.
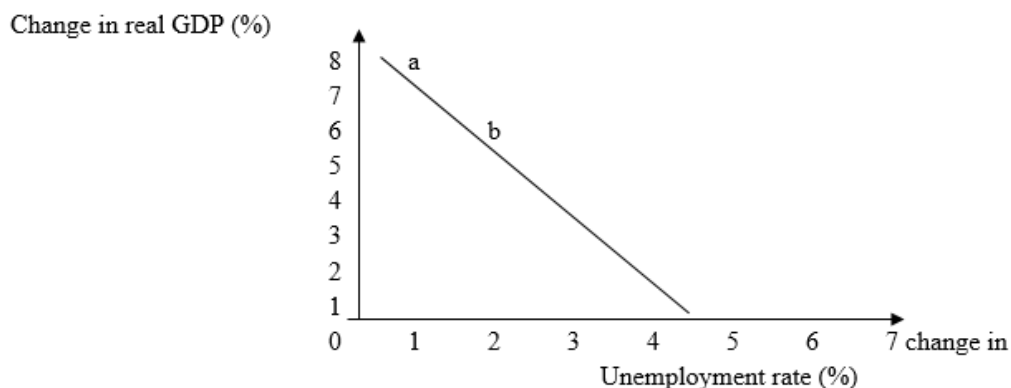
Fig 2: Okun's law illustrated.

According to Okun's law, for cyclical unemployment to be constant, actual GDP has to increase at the same pace as potential GDP and for cyclical unemployment to fall, actual GDP must rise faster than potential GDP.

Methodology
The methodology for measuring the sacrifice ratio for Nigeria entails the specification of a model to measure the sacrifice ratio for Nigeria's inflation reduction

Sacrifice Ratio Model
In estimating the sacrifice ratio for Nigeria, the study adopted the Ball (1994) model which was also used by Coffinet et al (2007) and Mazumder (2012) specified as follows;

$$SR = [\sum_{t=s}^{E+4}(y_t - y_t^*)] / (\pi_t - \pi_{t-1}) \qquad (6)$$

Where SR = Sacrifice ratio
$(y_t - y_t^*)$ = Sum of output losses over the disinflation period
$(\pi_t - \pi_{t-1})$ = Change in inflation trend

Year t is an inflation peak (trough), if inflation at t is higher than (lower) than inflation at t+1 or t-1, that is troughs and peaks are defined with reference to a year on both sides. Trend output can be calculated by connecting output at an inflation peak to output one year after the trough. The sum of the differences between the various levels of actual output throughout the episode (inclusive of the output one year after the inflation trough) and output at the inflation peak, gives the output loss for each episode. The output values are to be logged as prescribed by Ball (1994).

The formula specified above is guided by the following assumptions:
  a)   The natural level of output is at the start of a disinflation episode.

b) Output returns to its potential level four quarters after the end of an episode i.e, four quarters after an inflation trough. In terms of annual data, output returns to its potential level one year after an inflation trough.

c) Potential output grows log-linearly between two points when actual and potential outputs are equivalent.

Nature and Sources of Data

The study utilised secondary data. The use of secondary method was chosen because it is considered to be the most appropriate method for the needed information at the least period of time. For example, it saves time and it is cost effective. Therefore, the data for the study were obtained from the Central Bank of Nigeria (CBN) statistical bulletin, and the National Bureau of Statistics (NBS) publication. The required macroeconomic variables include; inflation rate and real GDP. The data used for the sacrifice ratio analysis covers the period of 46 years ranging from 1970-2016.

Model Specifications

Though there are many models that can be used to estimate sacrifice ratio, notable among them are Phillips curve Approach, Ball (1994) Approach and Mankiw (2010) Approach. Of these three measures, the Ball (1994) approaches will be adopted in this work.

The Ball (1994) Model:

To estimate the sacrifice ratio for Nigeria, the study also adopted the Ball (1994) model which was also used by Coffinet et al. (2007) and Mazumder (2012) which is specified as follows;

$$SR = [\sum_{t=s}^{E+4}(y_t - y_t^*)] / (\pi_t - \pi_{t-1}) \tag{7}$$

Where SR = Sacrifice ratio
$(y_t - y_t^*)$ = Sum of output losses over the disinflation period
$(\pi_t - \pi_{t-1})$ = Change in inflation trend

Year t is an inflation peak (trough). If inflation at t is higher than (lower) than inflation at t+1 or t-1, that is troughs and peaks are defined with reference to a year on both sides. Trend output can be calculated by connecting output at an inflation peak to output one year after the trough. The sum of the differences between the various levels of actual output throughout the episode (inclusive of the output one year after the inflation trough) and output at the inflation peak, gives the output loss for each episode. The output values are to be logged as prescribed by Ball (1994).

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c) Potential output grows log-linearly between two points when actual and potential outputs are equivalent.

Data Presentation, Analysis and Interpretation
Sacrifice Ratio
In order to determine the sacrifice ratio for Nigeria, the study adopted the Ball (1994) methodology and the following results were arrived at:

The disinflation episodes (inflation peaks and troughs) were first identified, as the periods in which the trend inflation falls substantially, which are shown in table 1:

Table 1: Trend Inflation Episodes

Episodes	Length of years	Inflation peak	Inflation trough	Change in inflation
1973-1974	1	18.5	9.5	9.0
1975- 1978	3	13.5	6.2	7.3
1981-1982	1	17.4	6.9	10.5
1984-1987	3	22.6	9.7	12.9
1989-1990	1	14.7	3.6	11.1
1993-1997	4	21.3	10.2	11.1
2005-2007	2	11.6	6.6	5
2008-2011	3	15.1	10.3	4.8
2012-2013	1	12.0	8.5	3.5

Source: Author's Computation.

To arrive at the sum of output losses during the disinflation episodes, the real GDP were first of all logged. This is because the real GDP values were too high in comparison with the inflation rates.

The numerator of the sacrifice ratio is calculated by summing up the differences between the actual levels of output throughout the episodes (inclusive of output one year after the trough) and output at inflation peak (trend level or full employment output). The output losses for each episode is summarized in table 2:

Table 2: Summary of Output Losses

Episodes	1973-1975	1975-1979	1981-1983	1984-1988	1989-1991	1993-1998	2005-2008	2008-2012	2012-2014
Output losses	-1.874	7.016	-0.104	4.890	4.205	4.777	5.378	6.272	4.896

Source: Author's Computation, 2019.

Given tables 3 and 4, the sacrifice ratio (cost of disinflation) can be calculated by taking the ratio of the sum of output losses in each episode to the change in trend inflation. The results of this study is summarised as follows in table 3:

Table 3: Summary of Sacrifice Ratios

Episodes	Length of years	Initial Inflation	Change in Inflation	Sacrifice ratio
1973-1974	1	18.5	9.0	-0.208
]1975- 1978	3	13.5	7.3	0.961
1981-1982	1	17.4	10.5	-0.010
1984-1987	3	22.6	12.9	0.379
1]989-1990	1	14.7	11.1	0.379
1993-1997	4	21.3	11.1	0.430
2005-2007	2	11.6	5	1.076
2008-2011	3	15.1	4.8	1.307
2012-2013	1	12.0	3.5	1.399

Source: Author's Computation, 2019.

Table 3 shows that output gap estimated for episodes 1972-1974 and 1981-1982 are negative suggesting that the disinflation episodes has resulted in output growth for the disinflation episodes in Nigeria. While episodes 1977-1978, 1984-1987, 1989-1990, 1993-1997, 2005-2007, 2008-2011 and 2012-2013 on the other hand are positive suggesting that the disinflation episodes has resulted in output losses for the disinflation episodes in Nigeria. The information provided above also estimates the average sacrifice ratio for Nigeria as 0.635 percent. The results shows that on the average, output fell by 0.635 percentage points when inflation reduce by 1 percent in Nigeria. In order words, for every percentage point that inflation is to fall in Nigeria, 0.635 percent of one year's GDP must be sacrificed. Thus, the null hypothesis of the size of Nigeria's sacrifice ratio is not significant is also clearly rejected.

T]he result of this work is similar to Adebanjo (2010) and Mazumder (2012) which states that disinflation causes output losses and raises output respectively. And unlike Adebanjo (2010) and Mazumder (2012), this study shows that different episodes of disinflation generate different costs.

Output and Unemployment Cost of Disinflation in Nigeria

To address the second objective, note that the calculated sacrifice ratio (0.635) is the same thing as the output cost of disinflation. So, based on this result and following the current version of the Okun's law which states that a change of 1 percentage point in the unemployment rate translates into a change of 2 percentage points in GDP, we go a step further to estimate the unemployment cost of disinflation by dividing the output cost of disinflation by 2, that is, 0.635/2 = 0.318. Which entails output cost of inflation reduction of 0.635 percent and unemployment cost of inflation reduction of 0.318 percent, this means that the percentage of a year's real GDP that must be forgone to reduce inflation by 1 percentage point in Nigeria is 0.635 percent, while the percentage of a year's unemployment that must be forgone to reduce inflation by 1 percent point in Nigeria is 0.318 percent. In other words, for every percentage point that inflation is to fall in Nigeria, 0.635 percent of one year's GDP and 0.318 percent of a year's unemployment must be sacrificed. Thus the null hypothesis of no significant output and unemployment cost of inflation reduction in Nigeria is clearly rejected.

How Output and Unemployment adjusts to Inflation Rate Changes in Nigeria

To address the third objective, based on the above results and following current version of the Okun's law which states that a change of 1 percentage point in the unemployment rate translates into a change of 2 percentage points in GDP, we again, go a step further to estimate the percentage sacrifice of Nigeria's GDP at years when inflation rate is reduced from two digit rates to single digit inflation rates and the corresponding unemployment that is sacrificed. The result is presented in table 4.

Table 4: Inflation rate reduction and percentages of GDP and unemployment sacrificed table

Year	% of Inflation Reduction	% of GDP Sacrificed	% of Unemployment Sacrificed
1974	9	5.72	2.86
1978	5.1	3.24	1.62
1982	10.5	6.67	3.33
1987	4	2.54	1.27
1990	11.1	7.05	3.52
2006	3	1.91	0.95
2007	2	1.27	0.635
2013	3.5	2.22	1.11
*The estimated output and unemployment costs of reducing inflation rate by 1 percentage point are 0.635 and 0.318 respectively, which is used to compute the percentages of GDP and unempl oyment sacrificed. *The years selected are years of single digit inflation rates in Nigeria within the period of the study.			

Source: Author's Computation, 2019.

In 1974, the inflation rate was reduced by 9 percent. The reduction in inflation rate results to 5.72 percent of the 1974 GDP sacrificed in the short run. Equivalently, this reduction in inflation led to a sacrifice of 2.86 percentage points of unemployment in the same year. This is

similar to other years as shown in the table. The highest percentage of GDP (7.05%) was sacrificed in 1990 with 11.1 percent inflation rate reduction. Also, the highest unemployment (3.52%) was sacrificed in the same year. The year marked a very low and stable inflation rate after the drastic inflation rate reduction. On the other hand, the lowest percentage of GDP (1.27%) was sacrificed in 2007 with 2 percentage point reduction of inflation rate, while the unemployment rate is 0.635 percent.

Furthermore, years of rapid disinflation rate recorded higher percentage of GDP sacrificed, as well as higher sacrifice of unemployment as in the case of 1990; whereas, years of moderate disinflation rate is associated with lower sacrifice of the percentage of GDP as recorded in 2007. This finding is in line with the views of the cold-turkey and the gradualist approaches to disinflation. In respect of the former, disinflation is done rapidly (higher disinflation rates) but higher sacrifice ratio while for the later disinflation is carried out gradually (low disinflation rates) with low output cost. Therefore, the different sacrifice ratios (higher and lower sacrifice ratios) of 1990 and 2007 for instance, are as a result of different speed of disinflation. Thus the null hypothesis of output and unemployment has not significantly adjusted to inflation rate changes in Nigeria is clearly rejected.

Policy Implications of Findings
Based on the findings of the study, the following implications hold:
1. A sacrifice ratio of 0.635 when compared with those of emerging African economies like South Africa and Ghana with sacrifice ratios of 1.53 and 5.1 respectively or Globally when compared to USA, Germany, Italy, France and Netherlands with sacrifice ratios of 2.4, 2.9, 1.48, 0.22 and 0.31 respectively calls for a continuous policy improvement and strengthening by the monetary authorities in order to attain far more smaller sacrifice ratio for the economy than has been previously attained.
2. An output cost of disinflation of 0.635 percent implies that for every percentage point that inflation is to fall in Nigeria, 0.635 percent of one year's GDP must be sacrificed. This implies that the output cost of inflation reduction is very low in Nigeria.
3. An unemployment cost of disinflation of 0.318 percent implies that for every percentage point that inflation is to fall in Nigeria, 0.318 percent of one year's unemployment must be sacrificed. This implies that the unemployment cost of inflation reduction is very low in Nigeria.
4. Having seen the quantity/size of the trade-off that exists between inflation and output/unemployment in Nigeria (1:0.635/0.318), it is equally worthy to note that between inflation and output/unemployment, what to actually trade-off for the other will be the choice of the Policy makers to decide. In Nigeria, over the years, the choice of the right policy to be pursued has made some administrations to be regarded as inflation averse administration and others as unemployment averse administrations depending on the prevailing economic situation in the country (level of inflation and unemployment) and the state of development at the time.

For instance, an inflation averse administration is always opposed to increasing the inflation rate to a higher level while the unemployment averse administration on the other hand, is

always opposed to increasing the unemployment rate to a higher level. Across the globe now, the attention is mostly on how to reduce the level of unemployment, which is considered more severe than high level of inflation. In Nigeria for instance, according to the current publication of the National Bureau of Statistics (NBS), the level of unemployment is 23.10 percent as at the third quarter of 2018 while that of unemployment is 11.31 percent as at February, 2019. Hence, it is obvious that the rate of unemployment is more severe than that of inflation rate, which calls for more inflation to be accommodated to reduce the level of unemployment. Meaning that the current administration should be unemployment averse. Therefore, policy makers' decision on the level of inflation and unemployment mix is determined by a balancing of the benefits and costs of moving to a new, lower level of inflation and unemployment in Nigeria

Conclusion

The study has attempted to empirically analyze the sacrifice ratio for Nigeria. From the findings of the study, we conclude that any reduction of the inflation rate significantly cost the economy in terms of output and employment lost in the short run. The output cost is 0.635 percent for 1 percentage point reduction in the inflation rate while the unemployment cost is 0.318 percent for 1 percentage reduction in the inflation rate. This implies that the sacrifice ratio is normal or moderate in Nigeria when compared with those of emerging African economies like South Africa and Ghana with sacrifice ratios of 1.53 and 5.1 respectively (kabundi, 2016; kinful, 2007), or Globally when compared to USA, Germany, Italy, France and Netherlands with sacrifice ratios of 2.4, 2.9, 1.48, 0.22 and 0.31 respectively (Ball, 1994).

The Ball (1994) method identified 9 disinflation episodes between 1970 and 2016. The results obtained suggested that 1% disinflation resulted in, output gain of 0.208 and 0.010 percent for each of 1973-1974 and 1981-1982 disinflation episodes respectively. And output loss of 0.961, 0.379, 0.379, 0.430, 1.076, 1.307 and 1.399 percent for each of 1975-1978,1984-1987, 1989-1990, 1993-1997, 2005-2007, 2008-2011 and 2012-2013 disinflation episodes in Nigeria respectively, resulting in an average sacrifice ratio of 0.635 percent for Nigeria.

The results of the output and unemployment cost of inflation reduction in Nigeria was 0.635 and 0.318 percent respectively. This means that the percentage of a year's real GDP and unemployment that must be forgone to reduce inflation by 1 percentage point in Nigeria is 0.635 and 0.318 respectively. In 1974, the inflation rate was reduced by 9 percent. The reduction in inflation rate resulted in 5.72 percent of the 1982 GDP sacrificed in the short run. Equivalently, this reduction in inflation led to a sacrifice of 2.86 percentage points of unemployment in the same year.

The highest percentage of GDP (7.05 percent) and unemployment (3.53 percent) was sacrificed in 1990 with 11.1 percent inflation rate reduction, while the lowest percentage of GDP (1.27 percent) and unemployment (0.635 percent) was sacrificed in 2007 with 2 percentage point reduction of inflation rate. Nigeria's economy over the years operated significantly above and below its potential level. There were periods the economy operated above potential level and periods it operated below potential level.

Finally, Nigeria recorded the highest performance above its potential level in 1980 and the lowest performance above potential level in 2002. On the other hand, 1981 marked the period Nigeria had the highest value below potential level and 2006 recorded the least value (performance) below potential level.

Recommendations
Based on the findings of the study, the following recommendations were arrived at:

I. Policy makers should make the creditability of inflation reduction policy a priority. In this way, disinflation can be achieved without any (significant) reduction in output and employment level. This is because, if people see that the policymakers always keep their commitments, then they will reduce their expectations of inflation as soon as the policymakers are credibly committed to keep the inflation rate down. If the policymakers have the reputation of keeping their commitments, the inflation rate may drop even without a rise in unemployment or a fall in output.

ii. The cold-turkey solution to inflation reduction is recommended the best for Nigeria given it's low sacrifice ratio of 0.635. The reason is that the output cost of disinflation in Nigeria is low and her inflation rate is high at double digit, hence, the cold-turkey approach will ensure a drastic reduction of the inflation rate from double digit to single digit that will be moderate enough to stimulate investment in the economy which is very necessary in addressing the problem of stagflation that the country is currently battling with. The gradualist approach raises the probability of future reversals and doesn't always have favourable impact on inflation expectations.

iii. This study has provided a valid solution for Nigeria's current economic problem of stagflation. If properly utilised by the Monetary authorities, the country's problem of stagflation will be addressed. This is because the actual sacrifice ratio for Nigeria has been identified to be very low. The major policy implication from this finding is that the CBN having seen that what it would cost the economy in terms of output and unemployment to reduce her high inflation rate is very low, should rapidly crash her inflation rate to a moderate figure within a single digit and bear the little output and unemployment cost (immediately) in the short run and be set to reap a bumper harvest from the sacrifice in the nearest future. This is because, this low inflation rate that would be actualized from the action will solved one of the stagflation problem of high inflation rate. This low/moderate level of inflation will at the other hand, stimulate the economy and return it to the path of prosperous economic growth again, hence solving the second problem of stagflation of slowdown in economic growth. Finally, the prosperous economic growth as a result of the drastic cut in inflation rate will bring about rapid reduction in the general unemployment level, hence solving the third problem of stagflation of rising level of unemployment.

Hence, this study, if well utilized by the CBN will effectively address Nigeria's current economic problem of stagflation.

References

Abel, A. B. & Bernanke, B. S. (2005). Macroeconomics, 5th ed. Pearson Addison Wesley. ISBN 0-321-16212-9.

Abel, A. B., Bernanke, B. S. & Croushore, D. (2008). *Macroeconomics*, 6th ed. Pearson Education, Inc.

Adebanjo, A. M. (2010). Estimating Small Scale Macroeconomic Model (SSMM) for Nigeria: A Dynamic Stochastic General Equilibrium (DSGE) Approach.

Algan, Y., Challe, E. & Ragotm X. (2006). Incomplete markets and the output- inflation tradeoff. *Paris-Jordan Sciences Economiques Working Paper* No. 45. Available online at: www.pse.ens.fr

Amarasekara, C. (2010). Have the sacrifice ratios changed under inflation targeting? An empirical investigation. A paper presented at the Central Bank of Sri Lanka Inaugural International Research Conference.

Ascari, G. & Ropele, T. (2012). Disinflation effects in a medium-scale new Keynesian model: Money supply rule versus interest rate rule. *Temi di Discussione Working Papers* No. 867, Bancad'Italia.

Ascari, G. & Ropele, T. (2010). Disinflation in a medium-scale DSGE model: Money supply versus interest rate rules. *Temi di Discussione Working/Papers* No. 736, Bancad'Italia.

Ascari, G. & Ropele, T. (2009). Disinflation in a DSGE perspective: Sacrifice ratio or welfare gain ratio, *Review of Economic Dynamics*, 7, 1-29.

Bakare, S. A. (2011). The trade-off between inflation and economic growth in Nigeria: The Phillips relation approach. *China-USA Business Review*, 10 (10), 928-935.

Ball, L. (1994). What determines the sacrifice ratio? *National Bureau of Economic Research Working Paper* No. 4306. Available online at: http://www.nber.org/chapters/c8332

Bashiri, E. & Amirkhiz M. N. (2015). Sacrifice ratio and disinflation cost for selected OPEC member countries: Panel data evidence, *International Academic Journal of Economics. 2*, (12), pp. 22-32.

Belke, F. & Böing, T. (2014). Sacrifice ratios for euro area countries: New evidence on the costs of price stability, *Ruhr Economic Papers* No.520. Available online at: http://dx.doi.org/10.4419/86788595

Binyamini, A. & Razin, A. (2008) Inflation-output tradeoff as equilibrium outcome of globalization, *Israel Economic Review*, 6 (1), 109-134.

Bowdler, C. & Nunziata, L. (2009) Labor market structures and the sacrifice ratio, *Journal of International Money and Finance*, 148-60.

Brito, R. D. (2010) Inflation targeting does not matter: Another look at OECD economies' output sacrifice ratios, *Insper Working Paper* WPE: 215/2010.

Central Bank of Nigeria (2016). *Statistical bulletin*, Abuja: CBN Press.

Central Bank of Nigeria (2015). *Statistical bulletin*, Abuja: CBN Press.

Central Bank of Nigeria (2012). *Statistical bulletin*, Abuja: CBN Press.

Cecchetti, S. G. & Rich, R. W. (2001) Structural estimates of the U.S. sacrifice ratio. *Journal of Business & Economic Statistics*, 19 (4), 416-427.

Celasun, Y. (2005). Inflation and disinflation. *Research Bulletin*, 6 (1), 1-12. Çetinkaya, A. A. & Yavuz, D. (2002) Calculation of output-inflation sacrifice ratio: The Case of Turkey. *Central Bank of the Republic of Turkey Research Department Working Paper* No 11.

Chinaemerem, F. & Akujuobi, D. (2012). Inflation targeting and monetary policy instruments: Evidence from Nigerian and Ghana. *Kuwait Chapter of Arabian Journal of Business and Management Review*, 1 (11), 52-81.

Chortareas, G., Stasavage, D. & Sterne, G. (2001). *Does it pay to be transparent? International evidence from Central bank forcasts.*, Bank of England working papers. Available online at: https://www.bankofengland.co.uk/archive/Documents/historicpubs/workingpapers/2001/wp143.pdf)

Chortareas, S., Magonis, G. & Panagiotidis, A. (2009). *Phillips curves and the measurement of disinflation costs: Traditional vs*. New Keynesian perspectives.

Coffinet, J., Matheron, J. & Poilly, C. (2007) A structural evaluation of the sacrifice ratio in the euro area. *Banque de France Digest* No. 60, April.

Coffinet, J., Matheron, J. & Poilly, C. (2007). Estimating the sacrifice ratio for the euro area. *Banque de France Bulletin Digest*, 160, 1-14.

Colander, D. C. (2006). *Macroeconomics 6th ed*. Mcgraw Hill.

Cukierman, A. (2002). Does a higher sacrifice ratio mean that central bank independence is excessive? *Annals of Economics and Finance*, 3, 1-25.

Cuñado, J. & de Gracia, F. P. (2000). *Sacrifice ratios in the emu countries: An empirical analysis*. Available online at: http://www.fedea.es/hojas/publicado.html

Daniels, J. P. & VanHoose, D. D. (2013). Exchange-rate pass through, openness, and the sacrifice ratio, *Journal of International Money and Finance*, 36, 131-150.

Daniels, J. P. & VanHoose, D. D. (2010). *Exchange-rate pass through, openness, and the sacrifice ratio, Working Paper* No. 05, Department of Economics, Marquette University. Available online at: http://epublications.marquette.edu/econ_workingpapers/5

Daniels, J. P. & VanHoose, D. D. (2008). Exchange-rate pass through, openness, inflation, and the sacrifice ratio. *Journal of International Money and Finance* 25, 1-25.

Daniels, J. P. & VanHoose, D. D. (2007). Trade openness, capital mobility, and the sacrifice ratio, *Working Paper* No. 03, Department of Economics, Marquette University. Available online at: http://epublications.marquette.edu/econ_workingpapers/41.

Daniels, J. P. & VanHoose, D. D. (2006). Openness, the sacrifice ratio, and inflation: Is there a puzzle? *Journal of International Money and Finance*, 25, 1336-1347.

Daniels, J. P. &VanHoose, D. D. (2004). Openness, the sacrifice ratio, and inflation: is there a puzzle? *Working Paper Series,* Baylor University.

Dholakia, R. H. (2014). Sacrifice ratio and cost of inflation for the Indian economy. *Indian Institute of Management Working Paper* No. 02-04.

Direkçi, T. B. (2011). Determination of the sacrifice rate in Turkey, Brazil and Italy: A comparison among countries. *Journal of Development and Agricultural Economics*, 3 (7), 335-342.

Dobrescu, M., Paicu, C. & Iacob, S. (2011). The National rate of unemployment and it's implications for Economic policy, theoretical and applied Economics, 2 (555), 181-194.

Dornbusch, R., Fischer, S. & Startz, R. (2008). *Macroeconomics*, 10[th]ed, McGraw-Hill/Irwin.

Dramani, L. & Thiam, I. (2012). Sacrifice ratio in West African Economic and Monetary Union (WAEMU). *Journal of Contemporary Management*, 61-70.

Durham, J. (2001). *Sacrifice ratios and monetary policy credibility: do smaller budget deficits, inflation-indexed debt, and inflation targets lower disinflation costs*?" Finance and Economics Discussion Series 2001-47, Board of Governors of Federal Reserve System.

Edeme, R. K., Ugbor, I. K., Emecheta, C. & Aduku E. B. (2018). Analysis of the impact of inflation reduction on output and unemployment, *Jurnal Ekonomi danstudipembangunam,* 10 (1), 2018.

Evans, L. & Nicolae, A. (2012). What matters most for the sacrifice ratio. *Newcastle Discussion Papers in Economics* No. 01, May.

Fontana, G. & Ononugbo, M. C. (2013). *The role of monetary policy in developing countries: What the Phillips curve postulates in Nigeria*, Economics Division, Leeds University Business School.

Formánek, R. & Hušek, T. (2005). *Estimation of the Czech republic sacrifice ratio for the transition period*, Prague Economic Papers, January.

Francis, N. & Owyang, M. T. (2004). *Monetary policy in a Markov-switching VECM: Implications for the cost of disinflation and the price puzzle.* Working Paper 2003-001D. Available online at: http://research.stlouisfed.org/wp/2002/2003-001.pdf

Frank, R. H. & Bernanke, B. (2001). *Principles of macroeconomics*, illustrated ed. McGraw-Hill/Irwin ISBN 0072289678, 9780072289671.

Fuhrer, J. C. (2009). Inflation persistence, *Federal Reserve Bank of Boston Working Paper* No. 09-14. Available online at: http://www.bos.frb.org/economic/wp/index.htm.

Gali, J., Gertler, M. & Lopez-Salido, J. D. (2005). Robustness of the estimates of the hybrid New Keynesian Phillips curve, *Journal of Monetary Economics 52* (6), 1107-1118.

Gonçalves, C. E. S. & Carvalho, A. (2007). Inflation targeting matters: Evidence from OECD economies' sacrifice ratios, *Journal of Development Economics*, 1-12.

Gordon, R. J. (2009). The history of the Phillips curve: Consensus and bifurcation. *NBER Working Paper*. Available online at: http://faculty-web.at.northwestern.edu/economics/Gordon.

Gozgor, G. (2013). The new Keynesian Phillips curve in an inflation targeting country: The case of Turkey, *International Journal of Economic Sciences and Applied Research*, 6 (1), 7-18.

Gujarati, D. N. & Porter, W. C. (2009). *Basic econometrics, 5th ed*, McGraw Hill.

Henry, P. B. (2007). Is disinflation good for the stock market? *CDDRL Working Papers* No. 79. Available online at: http://cddrl.stanford.edu

Hodrick, R.J. & Prescott, E.C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. Journal of Money, Credit and Banking, 29, (1) (Feb., 1997), pp. 1-16.http://www.jstor.org/stable/2953682.

Holmes, M. J. (2000). The output-inflation trade -off in African less developed countries. *Journal of Economic Development*, 25 (1), 41-55.

Humphrey, T. M. (2005). The evolution and policy implications of Phillips curve analysis. *Federal Reserve Bank of Richmond Economic Review*, 3-22.

Johansen, S. & Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration with Applications to Demand for Money" *Oxford Bulletin of Economics and Statistics* 52, 169-210.

Kabundi, A. (2016). *Sacrifice ratio based on the time varying Phillips curve for South Africa*, South African Reserve Bank Occasional Bulletin of Economic Notes, October.

Kinful, E. (2007). Estimation of short run trade-offs between stability and output, *Bank of Ghana Working Paper RD*.

Leitemo, K. & Røste, O. B. (2005). Measuring the sacrifice ratio: Some international evidence,, *Federal Reserve Bank of Richmond Economic Review*, 55-60.

Lendvai, J. (2004). Inflation inertia and monetary policy shocks, *Institute of Economics Hungarian Academy of Sciences Discussion Papers* No. 17.

Liao, Y. & Hu, R. (2013). Who influenced inflation persistence in china? A comparative analysis of the standard CIA model and CIA model with endogenous money. *SAJEMS SpecialIssue*, 16, 16-27.

Mankiw, G. (2010). *Macroeconomics, 7th ed*. Worth Publishers.

Mazumder, S. (2012). *Determinants of the sacrifice ratio: Evidence from OECD and non-OECD countries.*

Migap, J. P. (2011). Is monetary policy the best instrument for inflation targeting in the Nigerian economy?, *Journal of Business and Organizational Development*, 3, 35-43.

Morar, T.C. (2011). *Dynamic perspective on the triangle foreign direct Investments - Exchange rate -Capital Market.* In: Theoretical and Applied Economics. RePEc:v: 5 (558) (supplement) :y:2011:i: 5 (558) (supplement): p:624-634.

Moriyama, K. (2011). Inflation inertia in Egypt and its policy implications, *International Monetary Fund Working Paper* No. 160.

Muñoz-Torres, M. J., Fernández-Izquierdom, M.A. & Balaguer-Franch, M. R. (2004). The social responsibility performance of ethical and solidarity funds: An approach to the case of Spain. *Business Ethics: A European Review 13* (2-3), 200-218

Pickering, A. & Valle, H. (2011). *Globalization and the sacrifice ratio,*

Ravn, M. & Uhlig, H. (2002). *The review of economics and statistics, 84,* 2, 371-375. http://www.mitpressjournals.org/doi/pdfplus/10.1162/0034653023174116 link to full text (text/html)

Robert, J. G. (2012). *University of Chicago and the national bureau of economic researc*h.

Roberts, J. M. (2007). Learning, sticky inflation, and the sacrifice ratio. Kiel Working Paper No 1365. Available online at: http://www.ifw-kiel.de/pub/kap/kapcoll/kapcoll_02.htm

Samuelson, P. A. & Nordhaus, W. D. (2001*). Economics", 17*[th] *ed.* Mcgraw Hill.

Sanusi, A. R. (2015). *Monetary policy and inclusive growth: How costly are disinflations to inclusion in Nigeria?* A paper presented at the 56th Annual NES Conference.

Sbordone, A. M. (2007). Inflation persistence: alternative interpretations and policy implications. *Federal Reserve Bank of New York Staff Report* No. 286.

Serju, P. (2009). Estimating the output cost of disinflation: An application to Jamaica and Trinidad & Tobago, *Business, Finance & Economics in Emerging Economies*, 4 (1), 118-148.

Stock, L. & Vogler-Ludwig, K. (2010). *NAIRU and Okun's law: The macro- economy in a nut*shell.

Umaru, A. & Zubairu, A. A. (2012). An empirical analysis of the relationship between unemployment and inflation in Nigeria from 1977-2009, *Economics and Finance Review* 1 (12), 42-61.

Wooldridge, J. M. (2013). *Introductory Econometrics: A modern approach,* 4th ed. New York: South-Western Cengage Learning.