

Nexus between Budget Deficit and Inflation: Granger-Causality Test Approach

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Abstract: Budget deficit- inflation nexus is a recurrent issue in both developed and developing countries of the world which includes Nigeria. Hence the need to know which of the two variables (budget deficit, inflation) causes the other and also, the direction of causality. The aim of this study is to investigate both the nature and direction of causality between these two variables. With the view of providing empirical evidence on budget deficit operation in stimulating economic growth through inflation in Nigeria. The data used in this study was secondary sourced from the Central Bank of Nigeria's (CBN) Statistical Bulletin, 2019, and World Bank database. The Augmented Dickey fuller test was conducted to test the data for stationarity, inflation was found to be stationary at levels $I(0)$, while Deficit Budget became stationary at the first difference $I(1)$. Granger Causality pairwise test was carried out to determine the causal relationship among the variables. The result showed that there was no causal relationship between inflation and budget deficit ($F = 0.7, P > 0.05$) and vice-versa ($F = 1.4, P > 0.05$). This also implies that no directional causality from budget deficit to inflation exists in observed dataset.

Keywords— Granger-Causality, Inflation Rate, Budget Deficit, Nigeria

INTRODUCTION

The adoption of a budget deficit system can be traced back to the Keynesian inspired expenditure led growth theory of the 1970s, this theory which was adopted by most countries of the world states “that government has to motivate the aggregate demand side of the economy in order to stimulate economic growth”. However, its proceeding consequences on macroeconomic variables cannot be underestimated in most countries of the world, including Nigeria (Olomola & Olagunju, 2004). The deficit was introduced as a means of financing in Nigeria after the civil war. Since Nigeria gained independence over 85% of the Nigerian budget is on the deficit (Akinmulegun, 2014; CBN Statistical Bulletin, 2019). However, despite the extensive expansion of expenditure by the Nigerian government over the years, the projected level of economic development has not yet been achieved as the larger percentage of its citizens are still living in abject poverty. There is a persistently high mortality rate, poor road network, absence of standard medical facilities; shortage of food, and a high rate of unemployment (Ogunleye & Simon-Oke, 2004). Sequel to these, in order to fill the resource gap, the government resorted to the budget deficit. Remarkably, many economic policies of the government were implemented with the help of budget deficit and this includes the celebrated SAP of 1986, the financing of the so-called oil subsidy, the perennial insecurity problems, and even the 2011 and 2015 general elections were financed courtesy to budget deficit (Akinmulegun, 2014). Budget Deficit refers to a situation where expenditure done by the government exceeds the spending level in the process of ensuring economic performance (Monogbe, Dornubari, & Emah, 2015). In order for the extent to which the government has borrowed to be measured, all revenue and expenditure are required has to be considered, so as to ascertain its surplus or deficit. The inability of the government to pay up her debt increases debt servicing cost.

Also, the budget deficit could occur if the government is forced to spend beyond its tax revenue. In order to clear the deficit, the government needs to either create money or borrow. harmful to an economy. Although an increase in deficits has been sometimes associated with declining tax revenue which results from the recession, it has also been related to the increase in debt service payments on public debt. Inflation has been identified as one of the variables affecting budget deficit operation over the years in Nigeria. By definition, inflation is an appreciable and persistent rise in the general level of prices (Jhingan, 2002). Also, not every rise in price level is termed inflation. Hence, for any rise in the general price level to be considered as inflation, such a rise must be constant, enduring, and sustained. The rise in the price should not be temporary and affect almost every commodity. But Demberg and McDougall are more precise in defining inflation as the continuing rise in prices as measured by an index such as the Consumer Price Index (CPI) or by the implicit price deflator for Gross National Product (Jhingan, 2002). In an inflationary economy, it is hard for the national currency to serve as the main medium of exchange and a store of value without it having an adverse effect on income output, distribution, and employment (CBN, 1974). Inflation is usually characterized by a fall in the value of the country's currency and a rise in her exchange rate with other nation's currencies. Hence, demonstrating the sensitivity of the real exchange rate to fiscal deficits. In a country that depends overly on imports, like Nigeria, expansion of any fiscal policy has a way of weakening the exchange rate and depleting external reserves. A persistent rise in private consumption developments and expenditures in the external sector over the years have a strongly impacted budget deficit. Hence, most analysts argue that deficit reduction is vital to the future growth of an economy. Although, economists still are divided over their impacts, it is expected that lower budget deficits

will lower increase investment and real interest rates, thus increasing productivity, real income, and growth. A country experiences a deficit in its budgetary system when its expenses exceed its incoming revenue whereas budget deficit financing indicates the system a country operates its budget deficit. The source of budget deficit finance has varying impacts on inflation. There are controversies as to whether the budget deficit is inflationary or not. The sustained growth of deficit financing could barely take place without some amount of inflation, especially in a less developed country (Oyejide, 1972).

Statement of Problem

In developing countries, evidence of a positive relationship between inflation and budget deficit has been established (Oyejide, 1972; Buiiter, 1977; Siddiqui, 1989; Egwaikhide, 1991; Oladipo & Akinbobola, 2011). However, several issues have arisen on the deficit-inflation nexus, but two related questions have remained central: Does budget deficit and inflation have a causal relationship and if there is, what is the direction of the causality? Interestingly, while empirical review will examine the first question extensively little work has been done on the issue of causality between budget deficit and inflation in Nigeria (Oladipo & Akinbobola, 2011). The intent of this study is to fill this gap. we will investigate both the causality and direction of causality between inflation and deficit budget in Nigeria, using annual data from CBN statistical bulletin for the period 2000 to 2020. Therefore, the aim of this study is to authenticate which of these variables causes the other and the direction of causality in Nigeria.

Objectives of the study

1. To determine, if there exists a causal relationship between budget deficit and inflation rate
2. To identify the direction of the causal relationship between Budget deficit and inflation rate

Statement of Hypotheses

1. H_0 : Budget deficit does not ganger causes inflation rate
2. H_0 : Inflation rate does not ganger cause the budget deficit

2. Literature Review

2. LITERATURE REVIEW

2.1 Theoretical Framework

The model approach that is adopted in this study, has its backing from the Neo-classical school of thought. Friedman (1968) argued that in the long-run inflation rate could be controlled by monetary authorities, through the control of the money supply. That deficit can lead to inflation, but only when the economy output reaches a full employment level. Thus, although money-financed deficits are inflationary, bond-financed deficits need not be, because bond-financed deficits being inflationary or not, greatly depends on monetary authorities' current approach to these policies. If interest rates are fixed or stable, then bond-financed deficits can be considered inflationary, because it then calls for an

expansion in the money supply which ultimately leads to rising prices.

The Monetarists have also argued that there exists a positive link between monetary growth and government deficits, declaring that higher bond-financed deficits put upward pressure on non- government bonds and interest rates.

Sargent & Wallace (1981) backed the proposition that the Central Bank is obliged to monetize the deficit either or at present or later periods. This kind of monetization will result in an increase in the rate of inflation and money supply at least in the long-run period.

An alternative view was expounded by Miller (1983), which argued that government deficits are unavoidably inflationary irrespective of if the deficits are monetized or not. According to Miller, through different channels deficit policy leads to inflation and the Central Bank might then be forced into monetary accommodation of the deficits this is in line with the views explored by Sargent & Wallace (1981). Nevertheless, even if the Central Bank does not monetize the deficit, these deficits through crowding out are still inflationary. That is, non- monetized deficits still result in higher interest rates, higher interest rates in turn crowd out private investment, and finally reduce the rate of growth of real output.

Additionally, Sargent & Wallace (1981) revealed that if the time paths of government taxes and spending are exogenous, then bond-financed deficits become non- sustainable because it will drive interest rates excessively high and eventually the Central bank would have to monetize the deficit. This monetarization will increase the inflation and money supply in the long run. But, the monetarist argued that the only cause of inflation can be an increase in the money supply and they established, that a contributing factor to the rise in money supply is the budget deficit.

Lastly, From Friedman's theory of money, inflation is a monetary phenomenon. Hence, when the budget deficit is monetized it leads to increases in money supply which in turn, increases the price level. When the budget deficit is monetized, there exists a relationship between the money supply and the budget deficit.

2.2 Empirical Framework

Numerous studies have been conducted on the relationship between inflation and budget deficit both in developed and developing countries. A study to examine the interrelationship among budget deficits, money growth, and inflation by Tekin-Koru & Ozmen, (2003) in Turkey. The study used a tri-variates system containing budget deficits, Inflation, and Money Growth. Results from the study confirmed the quantity theory of money which states that "any change in the quantity of money will change prices as well in a more elaborate study". The nexus between inflation and budget deficit in South Africa between the years 1980 and 2012 was examined by John (2013). The vector Autoregressive Distributive model, VAR, and Granger causality were employed as estimation techniques. The results showed that the two variables responded significantly

and positively to each other and the causality that runs bi-directionally between the two variables. Darrat (2000) re-investigated the inflationary effects of budget deficits. His findings showed that besides money growth, a higher budget deficit also plays an important and direct role in the inflationary process in Greece. Cyril (2004), conducted a study on the impact of Inflation on growth performance in Namibia. The study used the ordinary least square test as an estimation technique. The result revealed that inflation if not controlled, was counterproductive. The effect of a budget deficit on inflation in Tanzania was examined by Solomon (2004). The study employed Error Correction and co-integration as an estimation technique. Results showed that the causal ram was uni-directional from the budget deficit to the inflation rate.

Finally, from the empirical literature above, there is an element of compatibility in the results and findings for the two variables. However, the majority of these were not conducted in Nigeria. This study is out to examine budget deficit – inflation causal nexus in Nigeria.

3. Research Methodology and Data Analyses

3.1 Model Specification

Sources of Data: This study sourced data from

- I. Central Bank of Nigeria’s (CBN) Statistical Bulletin, 2019.
- II. World Bank data storage

Method of Analysis: The method of study adopted in this study is analytical. The final step of the estimation methodology used in this study is to investigate the relationship between budget deficits and inflation through a Granger non-causality analysis. The analytical tool used is the ordinary least square regression tool and Granger causality test.

Granger Causality Test: According to Granger (1969), a variable X is said to Granger cause another variable Y, if Y can be better predicted from the past of X and Y together than the past of Y alone, other relevant information is used in the prediction.

We now state the Functional relationship:

$$Y_t = f(Y_{t-1}, X_{t-1}, \dots, X_{t-1}) \dots \dots \dots (1)$$

If X_t causes Y_t, the functional relationship will be

$$X_t = f(X_{t-1}, Y_{t-1}, \dots, Y_{t-1}) \dots \dots \dots (2)$$

Accordingly, inflation and budget deficit series are subsequently exploited within the p-th order vector autoregressive [VAR (p)] framework for the Granger non-causality analysis which is proposed by Granger (1969)

$$\text{Inflr} = \Theta + \sum_{i=1}^p \alpha_i + \text{Inflr}_{t-i} + \sum_{i=1}^q \beta_i + \text{D.Budget}_{t-i} + \varepsilon_t \dots \dots \dots (1)$$

$$\text{D.Budget} = \Theta + \sum_{i=1}^p \alpha_i + \text{D.Budget}_{t-i} + \sum_{i=1}^q \beta_i + \text{Inflr}_{t-i} + \varepsilon_t \dots \dots \dots (2)$$

Where,

D.Budget = Deficit Budget

Inflr = Inflation

4. Empirical Results

Time Series Properties of the Data

1. Augmented Dickey-Fuller (ADF)

Before estimating the model, the variables were subjected to the unit root test of stationarity using the Augmented Dickey-Fuller (ADF).

It is vital to note that stationarity of time series data denotes that the mean, variance, and auto-covariances (at various lags) are constant, no matter what time they are measured. In other words, they are time-invariant. This test is very important because it confirms the reliability of the above statistics, thus rendering it as a model that is suitable, reliable, and appropriate for both prediction and control purposes (Hill, Griffiths, & Lim, 2008). Empirically, the ADF tests involve running a regression of the first difference of a series against the series lagged once lagged difference terms and optionally with a constant and time trend. The null hypothesis being that the series in question is non-stationary (has a unit root) whereas, the alternative hypothesis is that the series is stationary (has no unit root).

Decision Rule

The decision rule for rejecting the null hypothesis is

- 1. The t-statistic which is derived from the test must be largely negative
- 2. And, its absolute value greater than the reported critical values.

Table 1 (appendix) shows the results of the test-ADF on the two variables being tested-Inflr (Inflation rate), and D.Budget (Budget deficit). The test on inflation rate at the level (I(0)) of the variable with the inclusion of a constant and a trend in the equations shows that the null hypothesis (H₀) can be rejected at the 1, 5, and 10 critical percent levels. While, the test on budget deficit after it was integrated to the order of one (I(1)), with only a constant and no trend rejected the null hypothesis(Ho) at the 1, 5, and 10 critical percent levels. The results lead to the conclusion that any dynamic measurement of the model in levels of the series is most likely to be appropriate and devoid of problems of spurious regression. We then proceed with the ordinary least square (OLS) estimation using the vector autoregressive estimates since it is a case of multivariate and the Granger-causality test. It should be noted, that all the variables are in log form.

2 Optimal Lag Length Determination

Optimal lag length (p) for the VAR model and Granger-causality analysis is determined by means of Akaike Information Criteria (AIC), Schwarz Criteria (SC), and Hannan-Quinn Criteria (HQ) which are presented in Table 2(appendix).

Rule of Thumb Rule: The information criterion with the smallest criterion value evidences the most ideal lag length to

employ. Following the rule of thumb, the information with the lowest criterion is the Akaike Information Criteria (AIC) at an optimum lag length of 2. Hence, the optimum lag length that will be used for the granger causality test will be 2.

3 Granger-Causality Test

Bi-Variate Causality

While regression analysis deals with discovering the existence of a relationship between two or more variables. It does not necessarily imply causality. In other words, regression does not verify causality or the direction of influence. In regression including time series data, because time does not run backward, events in the past can cause events to happen in the present while, future events cannot. This is the central idea behind the Granger Causality test. Nevertheless, it should be clearly noted that the question of causality is majorly philosophical with all kinds of controversies because at one end are people who believe that “everything causes everything”. And at the other end, are people who refute the existence of causality entirely.

The model was estimated using one lag for the variables. Granger-causality results from table 3 (appendix) shows that the null hypothesis which says that Budget deficit (D.Budget) does not Granger cause inflation and vice-versa cannot be rejected since the result is not significant with probability > 0.05. This implies that budget deficit does not granger-cause inflation. Since no causality was confirmed, this implies that there exists no directional causality running from budget deficit to inflation and vice-versa.

5. Conclusion

This study examined the causal relationship between inflation and budget deficit (nature and direction) in Nigeria. The review showed that while numerous researches were being carried out in developed countries, little attention was paid to the issue of nature and direction of causality in developing countries between budget deficit and inflation. This work reveals no evidence of causality between inflation and budget deficit. Although, our result established no causal relationship between inflation and budget deficit in Nigeria, there is still a need for more researchers to investigate further the nexus between budget deficit and inflation as many theories suggests otherwise.

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Appendix

Table 1: Augmented Dickey-Fuller Test

Variable	ADF Test	Order of Integration
Inflr	-4.393 (-3.556) **	I (0)
D.Budget	-3.162 (-1.692) **	I (1)

Note: Critical values are in parenthesis

* Implies 1% significance level

** Implies 5% significance level

*** Implies 1% significance level

ADF = Augmented Dickey-Fuller Test

Source: Data obtained from the CBN Statistical bulletin (2019)

Table 2: Optimal lag length Determination

Information Criteria (IC)	Akaike Information Criteria (AIC)	Schwarz Information Criteria (SIC)	Hannan-Quinn Information Criteria (HQIC)
0	6.53477	6.62455	6.56539
1	5.34911	5.61847	5.44097
2	4.93679*	5.38572*	5.08989*
3	5.02735	5.65585	5.24169
4	5.1891	5.99717	5.46467

Note: The value in bold represents the value and information criterion that will be used to determine the optimum lag.

Table 3: The Estimates of Causality Test

Pairwise Granger Causality Tests

Date: 21/07/20 Time: 01:17

Sample: 1981- 2019

Lag: 1

Null Hypothesis	Obs	F-Statistic	Probability
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D.Budget does not ganger causes Inflr	31	0.70016	0.5042
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Inflr does not ganger cause D.Budget	31	1.4729	0.2449
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