Monetary Policy Efficiency and Inclusive Growth in Nigeria: A Dea Approach

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Abstract: The study examined the efficiency of monetary policy in Nigeria for the period 1980-2015 based on annual data sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin (various issues) and World Bank Data Base. The result obtained through DEA show that monetary policy in Nigeria requires some allowable adjustments before efficiency can be achieved and thus, impact on inclusive growth. The result of SVAR framework indicate that the shock from money supply and financial openness substantially impact on inclusive growth. The study therefore recommends that government should adopt an efficient monetary policy instruments that would make monetary policy to reach optimum and impact significantly on the economy.

Keywords: DEA; SVAR; inclusive growth; monetary policy

JEL Classification: C67; O47; E52

1. Introduction

This current study attempts to evaluate the efficiency of monetary policy in Nigeria. We intend to know the efficiency scores for the input-output relationship of monetary policy instruments, what the implication is and what policy options are available to the policymaker. The study is country specific in nature as it focuses mainly on the Nigerian economy.

Much empirical works have been directed at investigating the impact of monetary policy on macroeconomic fundamentals as well as objectives; with a special focus on price stability and output growth. Interestingly, however, macroeconomic objectives are set of contradicting goals that has to be harmonized for the interest of all. Evidently, Okun's (1972) law focused on the trade-off between economic growth and employment generation; the Phillip curve analyse the short-run trade-

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off between inflation and unemployment. The exogenous nature of monetary policy presupposes that a quantum deplored towards the state of the economy should be effective. Hence, no research effort has been dissipated to set a policy rule for the overall interest of all economic agents in the economy.

Consequently, this study is novel in two major ways. It is the first to obtain composite scores for monetary policy instruments as against the use of respective instrument which usually render empirical investigations contradictory and sometimes, inconclusive. Secondly, it is the first study to address welfare component of growth known as inclusive growth. In this study, we seek to capture all monetary policy instruments as input variables and consider it impacts on inclusive growth; as an output variable. The merit of using inclusive growth as an output variable is that both the direct and indirect transmissions with which monetary policies impact on the growth process of the economy would have been captured. In addition to this introductory section, this study is further discussed under five other sections. Section two will focus on literature review; Section three sets the methodology; Section four focus on result and Section five, being the last, concludes and proffer possible policy suggestions.

2. Theoretical and Empirical Reviews

From a theoretical standpoint, the rational expectations hypothesis, the non-neutrality thesis, the Taylor's rule, liquidity trap theory and the transmission channels form the basis with which the efficiency of monetary policy has been studied. The rational expectation theory presupposes that the expectation of economic agents and current variables are the major factors influencing the workings of the economy; including that of monetary policy. The non-neutrality thesis is a contradiction to the Classical neutrality of money which suggests that temporary nominal wage and price rigidities are the basis for the non-neutrality of monetary policy in the short-run. Taylor (1995) opined that these two assumptions ensure that monetary policy can be considered efficient; at least in the short run. The Taylor rule describes the relationship between the interest rate and inflation and output. The rule suggests that an increase or decrease in the real interest rate depends on the deviation of output and potential output and deviation in actual inflation from the target inflation. The theory of transmission channels tries to explain the relationship between the monetary policy and final targets of the Central Bank and, thus, how it affects the real economy (Calvo, 1978).

Specifically, there appears no clear cut link between monetary policy efficiency and inclusive growth due to some understandable reasons. Basically, inclusive growth is a new phenomenon in the economic growth paradigm and theoretical development in their area is still very latent. However, the theoretical inference that

linked monetary policy to inclusive growth is anchored on the long-term effects of monetary policy. It was the extension to the neoclassical growth model popularized by Solow (1956) and later the development of endogenous growth models that have helped to clarify the mechanism by which money creation and inflation expectation; both being monetary policy instrument, are likely to influence long-term economic growth; which provide only a heuristic intuition for the concept of inclusive growth. More so, inclusive growth is considered to be broad-based and sustainable in nature (Ianchovichina & Lundstrom, 2009; Ianchovichina & Gable, 2011). While the neoclassical propositions align with the classical neutrality hypothesis; both in the short and long-term, most of the models emphasized that monetary policy that would positively affect any variable, such as the household savings rate, would have a real effect on economic growth. We seek a reformulation of the Sidrauski (1967) extension that includes money and inflation that if monetary policy could impact on productive employment, then, the link between monetary policy efficiency and inclusive growth can be established. For the endogenous growth theory, the household framework was decomposed from that of the firm in order to adequately trace the dimension with which money impacts on the economy.[1]

Carlos (2010) examined monetary policy and real currency appreciation. The study is based on behavioral equilibrium exchange rate model. The findings show that controlling for the influence of real side determinants, the peso-dollar interest differential had a statistically and economically significant long-run effect on the peso's real exchange rate.

Mohsen & Charikleia (2006) examined how stable is the demand for money in Greece. They proved that after incorporating CUSUM and CUSUMQ tests into cointegration analysis, the results show that even though M1 and M2 monetary aggregates are cointegrated with income and interest rate, the M2 money demand function is unstable while M1 is stable.

Young & Gwi (2016) explore the possible sources of the well documented uncovered interest parity (UIP) violation in the foreign exchange market i.e structural changes in monetary reactions to inflationary pressure in the conventional approaches to nominal exchange rate and how this small but important change has an effect on the empirical implications of UIP condition. They discovered that passive monetary reaction implying less frequent intervention by monetary authority tends to be more consistent with the UIP relation.

Marshal & David (1998) found out that optimal monetary policy is fully characterized in terms of an alternatives set of parameter restrictions. Optimal monetary feedback completely stabilizes deviations in commodity output by

[1]See (Andrade & Faria, 1994).

eliminating the influence of those current innovations but which agents cannot directly observed from the rational expectations of agents.

Pierdzoch (2003) examined the non-seperable consumption-labor choice and the international transmission of monetary policy shock. The findings revealed that the impact of monetary policy shocks on the current account is shut off by assuming that the preferences of households exhibit a particular non-separability between consumption and labor supply.

Kwang (2015) explained the delayed effect of monetary policy, the role of inventories and factor hoarding. The author accounted for some extraneous factors like high levels of dollarization, weak financial sectors, underdeveloped capital market and low monetization of economies. The study confirmed the importance of exchange rate pass through in transition economies with high dollarization. The findings also provided an empirical case for deepening the local financial sectors to improve the efficiency of monetary policy and to improve resilience to external and other shocks.

Rokon (2012) examined the effects of monetary policy shocks in Bangladesh. The study revealed that the liquidity effect and exchange rate effect of the monetary policy shock are realized immediately, while industrial production responds with a lag over half end the inflation rate responds with a lag of more than one year and monetary policy shocks are not the dominant source of industrial production fluctuation in Bangladesh.

Ghartay & Amonde (2013) using analytical narrative vector error correction model (AN-VECM) with cointegration as the identifying restriction. They discovered that in all cases, the impulse-response functions indicate that the MPI yields slightly superior results in both AN-VECMs and a positive shock in the MPI produce price and exchange rate results which are consistent with a priori expectations from economic theory, and mixed liquidity effect and real output results.

Karras (1999) examined monetary policy and the exchange rate: the role of openness. The findings revealed that monetary policy and exchange rate impact negatively on economy openness. Therefore, the more open the economy, the smaller the (short run) depreciation effects of a given increase in the money growth rate in the (long run. Rosaria, Alberto & Dreste (2008) examined making monetary policy more effective for the Democratic Republic of Congo (DRC). The paper looked at the challenges of conducting monetary policy in a context of high dollarization of the banking system and weak institution in DRC. The study covered the period 2002 – 2012 with six defining variables such as the monetary base (M1), nominal exchange rate, the Central Bank's policy interest rate, the CPI and food and oil prices while the methodology adopted is two-staged approach of identifying key determinants of inflation and estimating policy response function to inflation shocks within the ECM framework. The main conclusion from the

analysis showed that high dollarization of the economy was reflected in the long-run relationship estimated and that the Central Bank has been responsive to inflation shocks; using the policy rates to stem price increases. However, the analysis suggested that the instrument, if effective, takes at least six to eight months to have an impact on inflation. But the transmission mechanism was not clear as the pass through from the policy rate to other interest rates was weak.

Bilson (1978) investigate on whether the US monetary policy has tracked the efficient interest rate. The study proposed an alternative view of the real factors driving interest rate decisions as against the convention of setting short-term interest rate in response to inflation and some measure of the output gap. The study showed that rules in which the policy instrument tracks the efficient interest rate as the main measure of real economic developments fit the data better than equivalent specifications that respond to the output gap. Using a structural model within a New Keynesian DSGE framework of the Bayesian variants, the authors estimated its parameters and compared the fit of many alternative specification and found that policy that tracks the efficient interest rate is a more robust measure to track real economic development as against equivalent specifications that respond to the output gap; thus, proving the consistent superiority of the Wicksell rule over the Taylor rules.

Dolezal (2011) investigated the efficiency of monetary transmission mechanism in Croatia. The paper analysed the efficiency of monetary policy transmission through channels of exchange rate, money stock and interest rate on real economic activity and prices. The technique of analysis used is the Vector Error Correction (VEC) model and Johansen cointegration. The results indicated a long-run relation between monetary policy measures on one side and real economic activity and price levels on the other. The strongest long-run channel of monetary transmission is exchange rate channel while the money stock is strictly weaker. The results also showed an impact of the interest rate channel.

Barro & Gordon (1983) investigated the main impact of monetary policy on the economy and assessed the efficiency of the strategy of monetary policy in terms of attaining the specific macroeconomic goals. The author estimated the relationships between key macroeconomic variables representing monetary instruments and policy goals within the VECM framework. The study found, inter alia, that the main effect of monetary policy on the economy is its influence on nominal variables and inflation rather than on real output. Also, the author found that just a little deviation in the money supply can have very distorting effect on the exchange rate and inflation. Monetary authorities is seen to have little control over the monetary aggregates; hence, monetary aggregates and not be considered optimal monetary instruments.

Ramayandi (2009) assessed monetary policy efficiency in the ASEAN-5 countries. The study derived utility consistent social loss function as a metric for welfare to assess monetary policy efficiency in a small open economy model. An optimal monetary policy that minimizes the social loss function was solved using information on structural parameters estimated for a model that represents each of the selected ASEAN-5 countries. The results are largely consistent with the common wisdom in the literature, where policies based on credible commitment gave the best welfare outcome. The paper further examined the welfare implications of the currently adopted simple monetary policy feedback rule for each of the simple economies. The study suggested the possibility that monetary authorities in the sample countries may be optimizing over an objective function that differ from the social welfare function derived.

Cecchetti, Flores-Lagunes & Krause (2006) conducted a cross-country analysis of whether monetary policy has become more efficient. The study proposed a general method with basic structural model for analyzing changes in macroeconomic performance and identifying the relative contributions of improvements in the efficiency of monetary policy and changes in the variability of aggregate supply shocks. The authors applied their technique to a cross-section of 24 industrialised and developing countries for comparison of macroeconomic performance between the two periods of 1980s and 1990s and found that monetary policy became more efficient in the 1990s for 21 of the 24 countries. The results obtained showed that more efficient policy has been the driving force behind improved macroeconomic performance. This was found to also offset an increased variability of supply shocks in some countries.

The gaps in the literature are of both conceptual and methodological. Usually, both inflation and output stability has remained the two major indicators for capturing macroeconomic performance in the literature. However, our study focused largely on inclusive growth; as a more far-reaching and holistic measure with which to test the classical dichotomy hypothesis; and by extension, how monetary policy has been efficient in driving the economy. Different from inflation and output, inclusive growth is a long-term sustained economic growth that is broad-based across sectors and inclusive of a large part of a country's labour force, thereby, reducing unemployment significantly (Groepe, 2012). Methodologically, we employed the use of the Data Envelopment Analysis (DEA) as the most robust technique for investigating efficiency through an input-output framework. We considered this better than the estimation of efficiency frontier through minimization of the social welfare function but rather as an optimization process of the various monetary policy input to generate a given output.

3. Methodology

3.1. Theoretical Framework and Model Specification

The theoretical framework for this study is the reformulated neoclassical growth model. We seek a reformulation of the Sidrauski (1967) extension that includes money and inflation which state that if monetary policy could impact on productive employment, then, the link between monetary policy efficiency and inclusive growth can be established. In the literature, productive employment is the major variable that has been established to provide opportunities for economic agents to contribute to the growth process and share from the growth outcomes respectively.[1] Sidrauski (1967) employed systems of equations and set of assumptions and established that in a growth model in which utility maximizing families are the basic economic unit of the system, the long-run capital stock of the economy is independent of the rate of monetary expansion.

With two additional assumptions that money supply expands at a constant rate over time and that in a steady state, real money balances is also constant over time, Orphanide & Wieland (1999) extended this model and reached the conclusion that money is non-neutral and that a monetary policy that has the nominal interest falling over-time may sustain higher output and consumption forever. We reformulate the Orphanide & Wieland (1999) extension that the Sidrauski (1967) growth model considered economic agents with productive opportunities as the basic economic units of the system; then, the long-run capital stock of the economy would largely depend on the rate of monetary expansion as the economy would be imbued with absorptive capacity to utilize this monetary expansion and not result in increasing price level; hence a more efficient allocation of resources that continually reduce the cost of capital; albeit interest rate, overtime.

The Sidrauski (1967) model is specified as a representative agent model that solves:

$$\max_{(c_t, m_t)} \int_0^{\infty} e^{-pt} u(c_t, m_t) dt, s.t. \tag{1}$$

$$a_t = f(k_t) - \delta k_t - \pi_t m_t + v_t - c_{t,} \tag{2}$$

$$\lim_{t \to \infty} e^{-pt} a_t \geq 0. \tag{3}$$

Where; c_t is consumption, m_t is the real money balances, k_t is capital, $a_t = k_t + m_t$ is the asset, π_t is the rate of inflation, v_t is lump-sum government transfers, p is the

[1] See (Lledo & Garcia-Verdu, 2011).

rate of time preference while δ is the rate of depreciation. From the foregoing and in tandem with the inclusive growth determinants of Anand et. al., (2013), the functional form relationship of monetary policy efficiency and inclusive growth is therefore specified as;

$$GPPE = f(MPE, GFCF, GOVCONS, GNI\_1, TOP, FOP, INF) \quad (4)$$

Equation (4) above yield the empirical model of the form;

$$GPPE_t = \alpha_0 + \beta_1 MPE_t + \beta_2 GFCF_t + \beta_3 GOVCONS_t + \beta_4 GNI\_1_t + \beta_5 TOP_t + \beta_6 FOP_t + \beta_7 INF_t + \varepsilon_t \quad (5)$$

Where; GPPE is the real growth per person employed, MPE is the efficiency score of monetary policy obtained through the DEA process, GFCF is the gross fixed capital formation, GOVCONS is the government consumption, GNI_1 is the lagged of gross national income, TOP is trade openness and FOP is financial openness while INF is the rate of inflation. The scope of analysis for this study span 1980-2013 and data are obtained from the World Development Indicator (WDI, 2014); the Central Bank of Nigeria Statistical Bulletin (various issues). This period is found suitable for our study as it is considered long enough to trace the interaction between monetary policy efficiency and inclusive growth in Nigeria.

4. Results and Discussion

In this section, a systematic procedure would be followed to investigate the relationship between monetary policy efficiency and inclusive growth in Nigeria. To begin with, descriptive statistics of the variable included in our model were obtained in order to ascertain the statistical properties of the series under consideration. Following this, the efficiency scores of money policy input-output interactions was estimated. Essentially, the open market instruments of treasury bills and treasury certificates were taken as the input variables while interest rate and monetary base would serve as the output variables. The choice of both the treasury bills and treasury certificates is that these two tools remain the major potent monetary policy instruments for controlling the supply of money in Nigeria.[1] Also, the use of interest and the monetary base as output variables is informed by the submission that the interest rates is the major tool for stimulating the growth process of an economy.[2] The input-output relationship is the basic kernel of the Data Envelopment Analysis approach where we seek to examine how the input variables have assisted in ascertaining the response of the output variable(s). The idea here is that for monetary policy to be effective, it has to be able to stabilize price and stimulate growth in the economy through some

[1] See (CBN, 2016).
[2] See (Krause, 2004).

intermediate variables. For robustness sake, the study proceeded to employ the use of Structural Vector Autoregression (SVAR) model to trace the transmission mechanism of money policy to inclusive growth in Nigeria. Some diagnostics are carried out too.

Table 1. Descriptive Statistics

	GDPPE	MS	FOP	GFCF	GNI_1	GOVCONS	INF	TOP	FDI_GDP
Mean	4125.387	2939.505	0.195100	1017417.	218384.2	1069699.	20.57419	9.399343	3.241133
Maximum	6772.000	15158.62	0.345959	5137368.	341967.8	4955029.	72.80000	36.09101	10.83256
Minimum	2956.000	15.78674	0.000000	8799.480	156921.1	8064.390	5.400000	0.072361	0.663717
Std. Dev.	1214.334	4614.600	0.131976	1551160.	57054.61	1625416.	17.88925	10.50802	2.295737
Skewness	0.907833	1.542400	-0.591133	1.563988	0.927834	1.477438	1.451459	1.016701	1.686571
Kurtosis	2.326640	3.935675	1.637646	4.043780	2.496733	3.635546	4.074543	3.000939	5.858903
Jarque-BBera	4.843825	13.42232	4.202779	14.04522	4.775008	11.79965	12.37620	5.340688	25.25391
Probability	0.088752	0.001217	0.122286	0.000891	0.091859	0.002740	0.002054	0.069228	0.000003

Source: E-views Output

The figures in Table 2 detailed the statistical properties of the variables included in the model of estimation. The standard deviation shows that there has been marked dispersion away from the expected values for inclusive growth indicator (proxied as GDPPE), money supply (proxied as MS), gross fixed capital formation (proxied as GFCF), the previous level of income per capita; indicated as lagged gross national income (proxied as GNI_1) and government involvement which is indicated as government final consumption (proxied as GOVCONS). The implication is that investment in the Nigeria economy has been more than the absorptive capacity while government involvement in the workings of the Nigerian economy has exceeded its required level for the proper functioning of the economy. The supply of money has been counter-productive and created some disturbances towards price stability and stimulation of growth. The level of financial openness (proxied as FOP) and closely followed by that of foreign direct investment (proxied as FDI) has been the least dispersed with 0.13 and 2.30 standard deviation. The openness on trade (proxied as TOP) and the price level in the economy (proxied as INF) are also fairly dispersed from their expected values with 10.5 and 17.9 standard deviation values respectively. This suggests that these variables tarry with their expected values and could not be seen to be distorting. Except for the FOP, which is negatively skewed, all the variables are all positively skewed. The implication is that the dispersion from the expected value of the FOP is the only detrimental of all while others are only distorting. The Kurtosis show that only the openness on trade (proxied as TOP) is the only normally distributed series with 3.0 value; as expected of the benchmark for normal distribution. Other variables are either platykurtic or leptokurtic in nature. These variables either have a value for kurtosis below the benchmark or above the benchmark of 3.0. Specifically, only three variables; GDPPE, FOP and GNI_1 that are platykurtic with 2.3, 1.6 and 2.5 values respectively. However, a former test for normality through the use of the Jarcque-bera test indicate that both the mesokurtic and

platykurtic series are normally distributed as these variables (TOP, GDPPE, FOP and GNI_1) have Jarcque-bera probabilities that are greater than 0.05.

Data Envelopment Analysis of Monetary Policy Efficiency

Table 2. DEA Report

Microsoft Excel 12.0 Answer Report					
Worksheet: [Monetary_Policy_Efficiency.xls]					
Report Created: 9/11/2015 5:27:48 AM					
Target Cell (Min)					
Cell	**Name**	**Original Value**	**Final Value**		
$D$41	(Nbillion) LHS	433.9325	3.87564E-08		
Adjustable Cells					
Cell	**Name**	**Original Value**	**Final Value**		
$F$2	Weight (λ)	1	6.23661E-09		
$F$3	Weight (λ)	1	0		
$F$4	Weight (λ)	1	0		
$F$5	Weight (λ)	1	0		
$F$6	Weight (λ)	1	0		
$F$7	Weight (λ)	1	0		
$F$8	Weight (λ)	1	0		
$F$9	Weight (λ)	1	0		
$F$10	Weight (λ)	1	0		
$F$11	Weight (λ)	1	0		
$F$12	Weight (λ)	1	0		
$F$13	Weight (λ)	1	0		
$F$14	Weight (λ)	1	0		
$F$15	Weight (λ)	1	0		
$F$16	Weight (λ)	1	0		
$F$17	Weight (λ)	1	0		
$F$18	Weight (λ)	1	0		
$F$19	Weight (λ)	1	0		
$F$20	Weight (λ)	1	0		
$F$21	Weight (λ)	1	0		
$F$22	Weight (λ)	1	0		

$F$23	Weight (λ)	1	0		
$F$24	Weight (λ)	1	0		
$F$25	Weight (λ)	1	0		
$F$26	Weight (λ)	1	0		
$F$27	Weight (λ)	1	0		
$F$28	Weight (λ)	1	0		
$F$29	Weight (λ)	1	0		
$F$30	Weight (λ)	1	1.3623E-10		
$F$31	Weight (λ)	1	0		
$F$32	Weight (λ)	1	0		
$F$33	Weight (λ)	1	0		
$F$34	Weight (λ)	1	0		
$F$35	Weight (λ)	1	0		
$F$36	Efficiency Weight (λ)	3.12023E-12	1.57943E-09		
Constraints					
Cell	**Name**	**Cell Value**	**Formula**	**Status**	**Slack**
$D$42	(Nbillion) LHS	6.61713E-07	$D$42>=$F$42	Binding	0
$D$40	(Nbillion) LHS	5.40915E-09	$D$40<=$F$40	Binding	0
$D$39	(Nbillion) LHS	6.42911E-08	$D$39<=$F$39	Binding	0
$D$41	(Nbillion) LHS	3.87564E-08	$D$41>=$F$41	Binding	0
$D$43	Σλ LHS	4	$D$43>=$F$43	Not Binding	4

Source: Microsoft Excel Solver Output

The Data Envelopment Analysis (DEA) report detailed in Table 2 above suggests that monetary policy has not been efficient; either with respect to each of the years or generally. Originally, we expect that the efficiency score estimated through this DEA model approach unity (i.e. 1). However, the results obtained showed that it rather tends towards zero (0). The implication is that monetary policy instruments in Nigeria has not been able to hit it target over time and holistically. This result tends to indicated that money is neutral and that money does not really matter for inclusive growth in the economy. However, the scenario analysis in the table below (see Table 3) suggests that money can be made efficient; requiring some adjustment in order to stabilize price and stimulate inclusive growth of the Nigerian economy. There are allowable increase and allowable decreases for money policy to reach its optimum in order to engender inclusive growth in the country. The allowable increase appears to be tendered at a particular amount of 1E+30 while those of the allowable decreases vary over time. The shadow price shows the cost of obtaining additional one unit of a scarce resource; in the case policy instrument.

For a resource to have a shadow price, it must be truly binding; implying that all have been deployed towards optimum efficiency. Treasury bill, interest rate and monetary base are the variable that demands that additional policy deployment will require additional cost to bear on the economy; with the one with the highest cost being the rate of interest (see Table 3).

Table 3. Sensitivity Analysis

Microsoft Excel 12.0 Sensitivity Report						
Worksheet: [Monetary_Policy_Efficiency.xls]Efficiency_2006						
Report Created: 9/11/2015 5:29:21 AM						
Adjustable Cells						
		Final	Reduced	Objective	Allowable	Allowable
Cell	Name	Value	Cost	Coefficient	Increase	Decrease
$F$2	Weight (λ)	5.68348E-09	0	6	34.80256469	5.963783673
$F$3	Weight (λ)	0	5.109915105	6	1E+30	5.109915105
$F$4	Weight (λ)	0	9.312910823	8	1E+30	9.312910823
$F$5	Weight (λ)	0	13.10388459	8	1E+30	13.10388459
$F$6	Weight (λ)	0	15.12387939	10	1E+30	15.12387939
$F$7	Weight (λ)	0	16.57227337	10	1E+30	16.57227337
$F$8	Weight (λ)	0	16.60499616	10	1E+30	16.60499616
$F$9	Weight (λ)	0	25.18519461	12.75	1E+30	25.18519461
$F$10	Weight (λ)	0	35.32980323	18.5	1E+30	35.32980323
$F$11	Weight (λ)	0	22.8778252	18.5	1E+30	22.8778252
$F$12	Weight (λ)	0	22.98162033	14.5	1E+30	22.98162033
$F$13	Weight (λ)	0	54.99838069	17.5	1E+30	54.99838069
$F$14	Weight (λ)	0	101.7449226	26	1E+30	101.7449226
$F$15	Weight (λ)	0	97.3369132	13.5	1E+30	97.3369132
$F$16	Weight (λ)	0	92.11959608	13.5	1E+30	92.11959608
$F$17	Weight (λ)	0	88.82022078	13.5	1E+30	88.82022078
$F$18	Weight (λ)	0	86.1362547	13.5	1E+30	86.1362547
$F$19	Weight (λ)	0	207.5320637	13.5	1E+30	207.5320637
$F$20	Weight (λ)	0	202.3853246	14.31	1E+30	202.3853246
$F$21	Weight (λ)	0	343.1260322	18	1E+30	343.1260322

$F$22	Weight (λ)	0	427.9695457	13.5	1E+30	427.9695457
$F$23	Weight (λ)	0	535.7224961	14.31	1E+30	535.7224961
$F$24	Weight (λ)	0	680.6232367	19	1E+30	680.6232367
$F$25	Weight (λ)	0	748.6551765	15.75	1E+30	748.6551765
$F$26	Weight (λ)	0	787.1613619	15	1E+30	787.1613619
$F$27	Weight (λ)	0	728.7294931	13	1E+30	728.7294931
$F$28	Weight (λ)	0	508.8184967	12.25	1E+30	508.8184967
$F$29	Weight (λ)	0	288.6078976	9	1E+30	288.6078976
$F$30	Weight (λ)	1.33516E-10	0	9.8125	341.9570014	451.350635
$F$31	Weight (λ)	0	328.7667952	7.4375	1E+30	328.7667952
$F$32	Weight (λ)	0	780.2803372	6.125	1E+30	780.2803372
$F$33	Weight (λ)	0	1134.675082	9.1875	1E+30	1134.675082
$F$34	Weight (λ)	0	1486.659899	12	1E+30	1486.659899
$F$35	Weight (λ)	0	2015.054982	12	1E+30	2015.054982
$F$36	Efficiency Weight (λ)	1.44647E-09	0	0	1E+30	24.126
Constraints						
Cell	**Name**	**Final Value**	**Shadow Price**	**Constraint R.H. Side**	**Allowable Increase**	**Allowable Decrease**
$D$42	(Nbillion) LHS	6.48527E-07	0.103031489	0	1E+30	0
$D$40	(Nbillion) LHS	5.30135E-09	0	0	1E+30	0
$D$39	(Nbillion) LHS	6.30099E-08	-1.06044677	0	0	1E+30
$D$41	(Nbillion) LHS	3.5411E-08	1	0	1E+30	0
$D$43	Σλ LHS	4	0	0	4	1E+30

5. Conclusion and Recommendation

This study investigates the efficiency of monetary policy in Nigeria through the use of the Data Envelopment Analysis (DEA) approach. Through this method, we obtain efficiency scores for the input-output relationship of monetary policy instruments for each of the year and for the whole years. Using scenario analyses through sensitivity analysis, we determine the allowable reductions and additions to this instruments that would make monetary policy to reach optimum and impact meaningfully on the economy. It is important to note that the input variables are the treasury bills and treasury certificates while interest rate and monetary base constitute the output variables. The study further proceeded to examine the impact that monetary policy has on inclusive growth in the country using a Structural Vector Auto-Regression (SVAR) model. Also, the actual inflation rate was fitted to its targeted rate for the period under investigation for robustness sake. The striking finding for this study is that even though it has not been efficient, monetary policy in Nigeria requires some allowable adjustments before efficiency can be attained and, thus, impact on inclusive growth. More so, the results obtained through the

SVAR framework indicate that the shocks from money supply and financial openness substantially impact on inclusive growth. It sums up to mean that, even though non-neutral, monetary policy has not been efficient in driving inclusive growth in Nigeria.

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