EFFECT OF MONEY SUPPLY ON OUTPUT GAP IN NIGERIA

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Abstract: Estimate of output gap serves as the parameter used by policy makers in deciding the direction of a nation through the use of relevant monetary and fiscal policy instruments. However, the empirical link between output gap and other macroeconomic aggregates such as money supply has been scantly documented. This study examined the effect of money supply on output gap in Nigeria. The study adopted ex-post research design and used secondary data from 1994-2023, obtained from the World Development Bank Indicators (WDI). Data was analysed using Autoregressive Distributed Lag model (ARDL). The result showed that money supply (β = -0.1793, t = -0.0513) has a negative impact on output gap in the short-run while its effect (β = 22.5016, t = 7.6706) on output gap is positive in the long-run. The positive impact of money supply in the long run signifies that in the long term; money supply has a substantial impact on output gap. This study recommends the need to maintain prudent monetary policies to ensure stable money supply growth which can positively influence economic output over the long term.
KeyWords: Output Gap, Money Supply, Inflation, Interest rate.

Introduction

Output gap is an important macroeconomic indicator that provides valuable guide for decisions that concern the setting of monetary policy. It is often used by the central banks and international institutions to analyse and assess economic and price conditions (Takiyi et al, 2017). It is the difference between the actual and potential output measured as a percentage of potential output. Its estimate serves as the parameter used by policy makers in deciding the appropriate direction of a nation through the use of relevant monetary and fiscal policy instruments. It is a key determinant of inflationary pressure which arises when demand outshoots supply thereby constraining the capacity of the economy (Valadkhani, 2014). Output gap is useful in assessing the reliability and appropriateness of macroeconomics policies (Grigoli et al, 2015), the degree of pressure on a nation's economic capacity and the direction the economy is heading towards (Michaelides, & Milius, 2009). Due to the important role of output gap in setting microeconomic policies and managing inflationary pressure, it is attracting increasing interest in the empirical and theoretical literature.

Literature reveals that both negative and positive output gaps have effects on inflationary trend and consequently other macroeconomic variables including exchange rate and money growth through the effect on inflation (Valadkhan, 2014). However, existing studies differ

on the extent to which positive (rising) output gap and negative (falling) output gap affect inflation and the economy at large (Clements & Sensier, 2003; Clark et al, 2001). Studies have shown that when there is a large negative output gap, the required expansionary monetary policy to address the recession that is likely to occur will create more inflationary pressure (Valadkhani, 2014; Bonnet & Maron, 2010). Likewise, when there is a large positive output gap, the required contractionary monetary or fiscal policy to cushion the effect of the persistent increase in the general price level that is likely to occur may cause fall in output, low demand and worsen unemployment problem. Furthermore, there are differing views on the asymmetric effects of positive and negative output gap on inflation in the literature. While the traditional economists believed that aside positive output gap that is inflationary, negative gap may not necessarily lead to disinflationary pressure, the contemporary economists believed that inflation can emanate from both positive and negative output gaps (Nelson, 2009). So, Neither positive nor negative output gap is desirable for any economy (Julia & Stuart, 2018), the ideal state is when the actual and potential output are at equilibrium, that is, an economy is healthy when the actual and potential output are growing in the same pace such that the output gap remains at zero.

Money supply is the total amount of money` in circulation in a country at any given time (Anyanwu, 1993). Increase in the supply of money can induce inflation but the link between the two variables is not direct. One channel through which money supply affects inflation is through its effect on output gap (Milas, 2009). Meanwhile, previous studies on the relationship between output gap and inflation have largely ignored this money supply transmission channel. Meanwhile, the role of money supply is important for a proper analysis output gap nexus since there is a direct link between money supply and output growth. Supply of money influences the equilibrium value of output and employment because an increase in the supply of money will raise price of goods, reduce rate of interest which will in turn raise the level of investment and output. Furthermore, as reiterated by Justine and Julein (2021), if financial variables such as money supply are excluded from the output gap estimations, an observed and common indicator of the business cycles, external or financial imbalances that may cause recession in future may not be captured.

In the literature, there is an increasing interest of economic scholars on the link between money supply and output because of the important role it plays on economic growth of virtually all economies of the world (Dingela & Khobai, 2017). The contention of the new Keynesians is that changes in money supply affects real variables such as gross domestic product (actual output) and employment levels due to price stickiness and asymmetric information in the market. It means therefore, that economic growth may not be feasible in the absence of certain level of money supply and appropriate financial conditions (Domigo, 2001). Furthermore, the first set of indicators relevant for predicting price developments in the short-run are indicators on the cyclical state of the economy such as output gap and exchange rate (Asseninancher-wesch & Gerlach 2006). The second sets of indicators are monetary aggregates such as money supply which provide important information in the long-run price developments. These two set of indicators are used to predict inflation.

Growth in money supply is correlated with shifts in aggregate demand which has impact on output gap in turn and hence; on inflation. However, the major concern of the central bank of Nigeria is the problem of imprecise level of output and unpredictable economic environment when formulating economic policies such as monetary policy rate (CBN, 2014, Onanuga et al, 2016). In Nigeria, various monetary policy measures have been

experimented over the years to regulate the cost and quantity of money in circulation and achieve equilibrium in actual and potential output. Among these policies is the implementation of the Minimum Rediscount Rate (MRR) which was the earliest policy regime. In recent years, the MRR was replaced with the Monetary Policy Rate (MPR) in addition to other intervention instruments comprising of Cash Reserve Ratio (CRR), Open Market Operation (OMO), and Foreign Exchange Net Open Position. These policies have remained less successful due to the inflationary trend and the rising macroeconomic uncertainties in the country (Agu, 2007).

Currently, Nigerian economy is characterized with structural rigidities and bottlenecks such as weak production base and undiversified nature of the economy, import dependent production structure and fragile export base. Weak non-oil export earnings have caused dwindling fortunes of the naira; consequently, negative output gap where output falls below its potential. In the midst of current exchange rate crisis in Nigeria, prices of commodities escalate on daily basis; the economic transition process in Nigeria is challenged by the decline in productivity as well ashigh rates of inflation. The high rate of inflation deprives the country's currency from functioning as a means of storing value due to its rapid and continuous slide against the US Dollar.

There has been increasing interest in the literature in the investigation of the factors such as output gap that serves as the parameter used by policy makers in deciding the direction of the monetary policy in terms of the volume of money that flows into the economy. However, some studies focused on using output gap to predict domestic inflationary pressures while the empirical link between output gap and other macroeconomic aggregates such as money supply has been rarely explored. This study addresses this gap by investigating money supply and output gap nexus in Nigeria. The study measured the output gap in the Nigerian economy with a view of assisting policy makers in effective implementation of their policies in the midst of the country's growth challenges and assist in determining the most effective set of policy measures. It will assist economists and financial managers in predicting future path of money supply stance of the monetary authority as it will provide a clear and quantifiable reactions and functions identifying a set of variables that forms the monetary policy. This research work will also help scholars to have clear knowledge on the importance of output gap and its relationship with money supply.

Literature Review

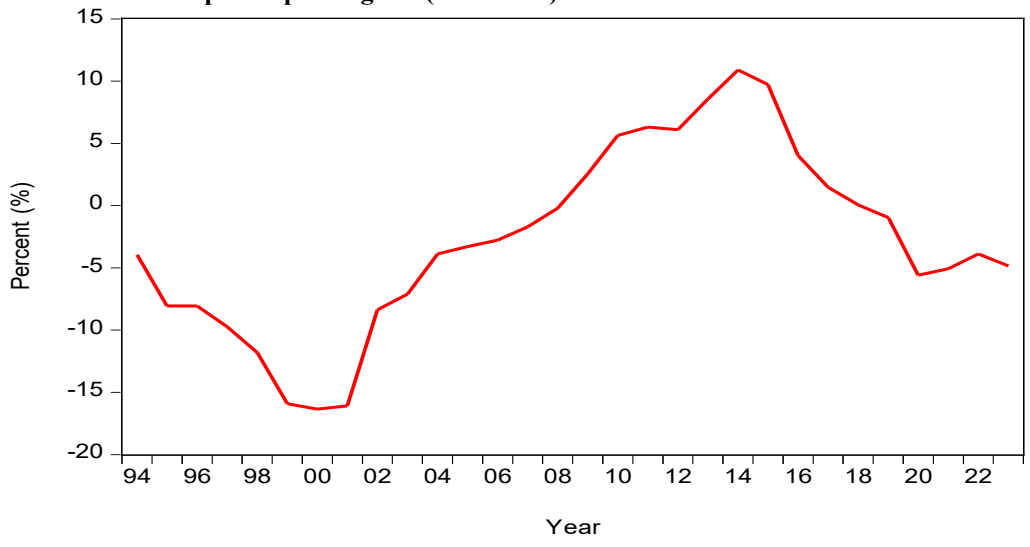
Output gap is a pertinent indicator that helps in decisions that concern the setting of monetary policy (Pedro & Adesina, 2022). Monetary and fiscal authorities frequently resort to output gap when analysing the cyclical position of the economy including deviations of unemployment from its natural rate (Grigoli et al, 2015). The derivation of output gap remains one of the most debated themes in empirical studies due to the biasedness of estimates and absence of uniformity in the measurement of potential output which to some authors, is not observable. Potential output is the sum of the average growth of labour input, capital and the efficiency with which these factors are used. The concept potential output may be seen from different angles; from the statistical perspective, it is the trend or smooth component of the actual output series. From economic point of view, it is seen as the sustainable aggregate supply capabilities of the economy (Luis et al, 2018). The output

gap and the potential growth rate are often used by the central banks and international institutions to analyse and assess economic conditions (Takiyi et al, 2017).

Potential output is an unobservable concept and due to the problems associated with its measurement, it has no uniform measurement. Some studies have used different statistical and theoretical constructs to measure potential output (Michaelides & Milos, 2009). The statistical approach includes the use of Hodrick-Prescott (HP) filter, the linear trend method, structural VAR and the quadratic trend method using the data on the actual output (Satti & Malik 2017). The theoretical construct on the other hand includes the simultaneous approach using the Extended Kalman Filter (EKF) (Valadkhani, 2014), and production function (Michaelides & Milos, 2009) through the use of the information provided in the production function such as labour, capital and technology. The production function does not take cognisance of the influence of structural shocks on potential output (Michaelides & Milos, 2009), and this may account for the reason why it is often less preferred to the statistical approach.

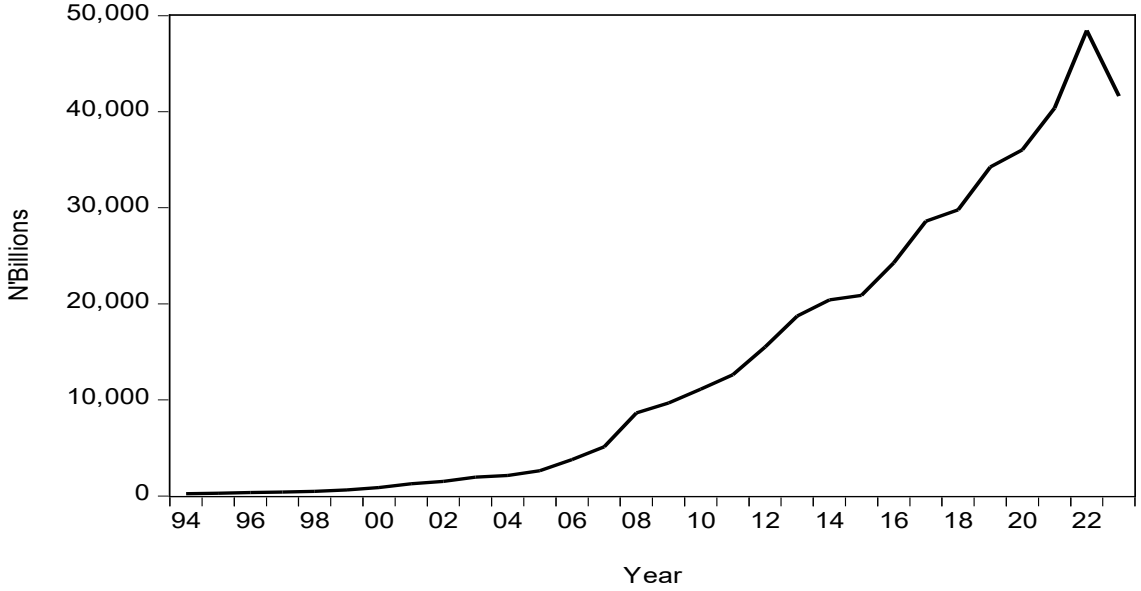
Money supply is the quantity of currency in circulation plus the amount of demand deposits in the bank (Adak, 2017). Generally, money supply is classified into narrow (M0 and M1) and broad money (M2, M3, M4, and M5). Narrow money includes coins and notes in circulation as well as their equivalents that are highly liquid, while broad money is narrow money plus short-term time deposits in banks, money market funds, and longer-term time deposits. However, what constitutes either of these components varies with countries. The broad money supply (M3) in the United States, for example, comprises M2 plus treasury bills, bonds and commercial paper (Maitra, 2018). The central bank of Nigeria has two measures of money supply; first, narrow money (M1) which is the total currency in circulation (CIC) with the non-bank public and demand deposits or current accounts in the banks (CBN, 2006). The second is broad money (M2) which includes narrow money plus savings, and time deposits. The CBN has however added (M3), which comprises (M2) and foreign currency; deposits ie domiciliary account to the definition of money supply. This study adopts M3 as the working definition of money supply. The trend analysis covers the trend of the key variables used in this study; output gap Nigeria, and money supply in Nigeria from 1994 to 2023.

Figure 1: Trend of Output Gap in Nigeria (1994-2023)



The trend in output gap in Nigeria for the period under review is displayed in Figure (2.2). It reflects significant fluctuations in the Nigeria's economic performance over the years. The negative output gap reaching almost -15% from 1994 to 2000 could indicate a period of economic underperformance, where actual output was below potential output, possibly due to political instability or economic policies that were not conducive to growth. The shift to a positive output gap from 2000, peaking above 10% around 2010 suggests a period of economic overheating, where actual output exceeded potential output. This could be attributed to factors such as increased oil prices, which significantly impact Nigeria's economy or reforms that boosted economic activity. The sharp decline back into negative territory from 2010 to 2018 indicates a contraction in the economy, potentially due to falling oil prices, global economic downturns and domestic challenges such as insecurity affecting economic activities. The slight rise towards a positive output gap towards 2022 again could reflect a recovery phase, possibly due to efforts in diversifying the economy or stabilizing oil prices.

Figure 2: Trend of Money Supply in Nigeria (1994-2023)



The trend in Figure (2) displays Nigeria's money supply from 1994 to 2023. In the Figure, from 1994 until around 2008, the money supply remained relatively stable. However, starting in 2008, there was a noticeable increase in the money supply, which became more pronounced between 2018 and 2022. A dip can be noticed in 2023. The increasing money supply could be influenced by various factors such as economic policies, inflation rates, and changes in government spending

Several studies abound on output gap and money supply nexus. Gaspar and Smet (2002) investigated how the presence of pervasive financial frictions and large financial shocks changes the optimal monetary policy prescriptions and the estimated dynamics in a new Keynesian model. Eleven quarterly observable series for the U.S economy were used while the financial accelerator model output gap features method was employed. The result shows that financial factors affect the optimal policy only to some extent. Rafiq and Malik (2008) examined the effect of monetary policy shocks on output in three Euro-area economies; Germany, France and Italy using a new VAR identification procedure. The

result showed that monetary policy innovations are potent in Germany. However, the study concluded that monetary policy innovations play a significant role in generating fluctuations in output for the three countries. Biswas (2014) analysed the impact of the output gap in market excess returns. The full sample study period covers 1948 to 2010 involving 756,252, and 63 total observations for the monthly, quarterly and annual returns respectively. The result showed that the output gap might be useful for forecasting market excess returns in real time.

London (1989) examined the role of money supply and exchange rate in twenty-three African countries for the period between 1974 and 1985. The application of the pure monetarist model of the Habergeon-type revealed that the growth in money supply and real income are significant determinants of inflation. Shafik (1995) covered the period of 1965 to 1988, employed Error Correction Mechanism to find the relationship between money supply and output growth in Ghana. The study suggests that growth in money supply is the principal variable that explains the Ghanaian inflationary trend.

Gaspar and Frank (2002) examined the reasons why monetary policy should primarily focus on price stability rather than the stabilization of actual and potential output. Assumption was based on Central Bank, private sector and the level of potential output. The result showed that emphasis on price stability helps to anchor inflation expectations leading to superior outcome in terms of overall macro-economic stability. Arestis and Sawyer (2008) employed autoregressive distributed lag model (ARDL) to investigate the effect of monetary and fiscal policy on economic growth in South Asian countries using annual data from 1990 to 2007. The result showed that money supply has a positive and significant effect on output in the short and long run. Zapodeanu and Cocuba (2010) investigated the link between money supply and output in Romania for period of 10 years, using Engle-Granger and ARMA model; the study inferred that money supply is closely related to output. Maitra (2010) examined the anticipated money, unanticipated money and output variation in Singapore between 1990 and 1992, using cointegration model, result showed that money supply and output are cointegrated.

Keneetti et al, (2016) studied the impact of exchange rate regimes on output growth in Nigeria in different periods from 1970 to 2014. Employing the Generalised method of moments (GMM) to estimate output equation as a result of endogeinity problem, the result revealed that deregulated exchange rate spurred growth in output as against the whole period of fixed exchange rate regimes. Mukhtar and Muhammed (2017) examined the effect of money supply on economic growth in Nigeria between 1981 and 2015 using vector error correction model (VECM) to measure the short run dynamics, Johansen cointegration approach to check the long run relationship among variables used and pairwise Granger causality test to check the direction of the causality between the variables. The result confirmed long-run relationship among the variables; interest rate has positive significant impact on output while real exchange rate has negative significant effect on output. A study on the impact of money supply on the growth of the Nigerian economy carried out by Udumuso (2019), using new classical production model and applied econometric techniques revealed that money supply has a negative impact on output in the run.

Iorember et al, (2021) scrutinised the impact of monetary policy shocks on domestic output growth in Nigeria between 1981 and 2019. The study employed Autoregressive Distributed Lag and VECM Granger causality and found that shocks in money supply have positive

impact on domestic output growth in the long run while shocks in exchange rate have negative impact on domestic output growth in the long run. There is also a unidirectional causality from money supply to real gross domestic product and from real GDP to exchange rate in Nigeria. Pedro and Adesina (2022) carried out a study on the impact of monetary policy shocks on output gap in Nigeria between 2002 and 2018 using the Autoregressive Distributed Lag and Differenced Ordinary Least Square estimation techniques. Result of findings showed that exchange rate is a significant and important macroeconomic variable for monetary policy and that inflation and interest rate is not relevant in the estimate and determination of output gap.

Methodology

This study assessed the effect of money supply on output gap. Ex-post facto research design was employed. The choice of the research design is because the issues investigated are events that have taken place and the researcher had no direct control over the endogenous variable and the two explanatory variables. This study hinges on the theoretical framework of the IS-LM model. The IS-LM model is a macroeconomic tool that describes the relationship between interest rates and real output in the goods and services market and the money market. It provides an explanation within the framework of Keynesian economics, addressing how the model can be used to represent Keynesian views on the economy (Hicks, 1980). The IS curve represents equilibrium in the goods market and shows the combinations of interest rates and output levels for which aggregate demand equals aggregate supply. It is represented by equation (3.1)

$$Y=C(Y-T)+I(r)+G+NX(e) \quad (3.1)$$

Where:

Y = Output; C = Consumption function; T = Taxes; I = Investment function; r = Interest rate; G = Government spending; NX = Net exports function; e = Exchange rate

The output gap directly affects the position of the IS curve. When the economy is operating below its potential (negative output gap), aggregate demand is insufficient to utilize all available resources. As a result, the IS curve shifts outward to the right, indicating that higher level of output is required to achieve equilibrium at a given interest rate. Equation (3.1) thus becomes

$$Y=C(Y-T)+I(r)+G+NX(e)+OutputGap \quad (3.2)$$

Where:

All else are as earlier defined but OutputGap=Y-Y_Potential

Where Y = Actual output, = Y_Potential = Potential output

On the other hand, the LM curve represents equilibrium in the money market and shows combinations of interest rates and output levels for which money supply equals money demand.

$$M/P=(L(r,Y) \quad (3.3)$$

Where:

M = Money supply; P = Price level; L = Money demand function,

The output gap influences the position of the LM curve indirectly by affecting money demand. When output is below potential, money demand tends to be lower, leading to a lower equilibrium interest rate to maintain the equality between money supply and money demand. This results in a lower level of output than potential. Conversely, when output

exceeds potential, money demand increases, leading to a higher equilibrium interest rate. Therefore equation (3.3) adjusts to

$$M/P=(L(r,Y+Y\_Gap) \quad (3.4)$$

Where Y_Gap is output gap

The IS-LM model focuses on two main equilibrium conditions: the goods market and the money market. Each market is influenced by a key variable:

The IS curve reflects the equilibrium in the goods market, where total spending equals total output. The key variable here is the real interest rate (r). Changes in the real interest rate impact factors like planned investment, influencing equilibrium output (Y).

The LM curve represents the equilibrium in the money market, where money supply equals money demand. The key variable for the LM curve is the real interest rate (r) as well. However, in this context, the real interest rate affects the demand for money.

The effect of an increase in money supply on output gap can be analysed through its influence on interest rates and subsequently on aggregate demand. That is

$$Y\_Gap=f(\Delta M) \quad (3.5)$$

Where ΔM is change in money supply

Changes in exchange rates can impact net exports, influencing aggregate demand and hence the output gap. Such that

$$Y\_Gap=f(\Delta e) \quad (3.6)$$

Where Δe is change in exchange rate

The combined effects of money supply and exchange rate on output gap becomes

$$Y\_Gap=f(\Delta M,\Delta e) \quad (3.7)$$

In an estimable form, equation (3.7) can be re-written as

$$Y\_Gap=\beta\_0+\beta\_1\ \Delta M+\ \beta\_2\ \Delta e+\varepsilon \quad (3.8)$$

Where: Y_Gap is the output gap; ΔM represents the change in money supply; Δe represents the change in exchange rate; β_0, β_1 and β_2are the coefficients to be estimated, and ε is the error term capturing unobserved factors influencing the output gap.

Empirical studies that have evaluated output using the IS-LM include Nusair & Olson (2021) where the main determinants of output were real supply of money, the real exchange rate, and the real wage for ASEAN-5 countries. Another study is Mrabet et al, (2023) in a study on output response to fiscal policy in Syria.

This study estimated the output gap using potential output obtained by applying the Hodrick-Prescott (HP) filter on actual output data. The estimate of the output gap (OUG) is given as:

$$OUG = \frac{\text{Actual output} - \text{Potential output}}{\text{Potential Output}} x100$$

Where OUG = output gap, Actual Output = the total amount of goods produced (GDP), Potential output = the output level under the condition of full employment of resources

In an attempt to investigate the impact of money supply on output gap, this study adapted the model used in the work of Grigoli et al, (2015) which was extended by Pedro and Adesina (2022). This study is country specific, it is limited to Nigeria, the key variables are output gap (oug), money supply (ms), exchange rate (exch) and the explanatory variables; however, inflation rate (inf) and interest rate (int) is also incorporated and the model becomes:

$$Ougt = \alpha + \beta mst + \theta exch\ t + \lambda inf\ t + \phi int\ t + \mathcal{E}t \quad (3.10)$$

α is the constant value, β, θ, λ and ϕ are the parameter estimates, ζ is the error term while t is the time.

$$Oug\,t = \alpha + \beta lnmst + \theta lnexcht + \lambda inf\,t + \phi int\,t + \zeta t \quad (3.11)$$

Autoregressive distributed Lag (ARDL). The ARDL was employed due to the nature of data. Some are stationary at level while others are integrated in their first difference.

Output gap (OUG) was measure by the difference between the actual output of an economy and its potential output. A positive output gap indicates that the economy is operating above its potential, suggesting inflationary pressures, while a negative output gap suggests that the economy is operating below its potential, indicating a potential for increased economic activity).

Rate of exchange is measured as the official exchange rate in local currency units (LCU) per US dollar. The exchange rate represents the value of one currency in terms of another and plays a crucial role in international trade and capital flows. Money supply, specifically M2 includes currency, demand deposits (M1), as well as saving and time deposits. Monitoring the money supply is important as it provides insights into the overall liquidity in an economy. Lending interest rate is measured as a percentage (rate) and represents the interest rate charged by banks for lending money in Nigeria. This variable is important as it reflects the cost of borrowing for businesses and individuals, influencing investment decisions and overall economic activity. Inflation is measured as consumer prices in annual percentage. It represents the rate at which the general level of prices for goods and services is rising and, therefore, reflects the purchasing power of a currency.

Table 1 Definition of Variables, Unit and Measurement

S/N	Variables	Description	Unit	Measurement
1.	OUG	Output gap	Rate	Actual output minus Potential output/ potential output x 100.
2.	EXR	Exchange rate	Official exchange rate in Naira	Real exchange rate
.3.	MS	Money supply	Billions in Naira	(M_2) i.e M_1 + saving and time deposit
5.	INT	Lending rate	Percentage (rate)	Bank rate of lending in Nigeria.
6.	INF	Inflation rate	Consumer prices in annual %	Inflation rate

This study employed secondary time series data which covers 1994 to 2023. The data were sourced from various issues of the World Development Bank Indicators (WDI). In estimating the impact of exchange rate and money supply on output gap, time series data for period 1994-2023 was used. The estimation time series data involves several stages in order to determine the regression model to be estimated because time series data are usually non stationary at level. This study employed both descriptive and econometric techniques. The descriptive statistics deals with the estimation of the statistical characteristics of the variables under study. These include minimum, maximum, mean, median, standard deviation, skewness, kurtosis, Jarque-Bera probability, etc. Stationarity and cointegration test for the co-movement of all variables was conducted using Augmented Dickey-Filler (ADF) and Philip Peron unit root test; this showed that some series are in order of I(0) while others are integrated in their first difference, I(1). Autoregressive Distributed lag (ARDL) econometric technique was used. This technique was developed by Peseran and Shin (1999) and used by Peseran, Shin and Smith (2001). ARDL allowed for joint

estimation of relationships between money supply and output gap; exchange rate and output gap, it also helps to verify if the two independent variables, money supply have impact on output in Nigeria. It is an unbiased estimation of a long-run model which has advantages over some other conventional techniques.

Results and Discussion

The descriptive statistics table provides a detailed overview of several key economic variables, shedding light on their central tendency, variability, distributional characteristics, and normality. In the descriptive statistics result presented in table 4.1.1, the mean and median output gap of approximately -2.75 and -3.59 respectively suggest that, on average, the economy operates below its potential output level. However, the distribution of the output gap data appears to be relatively symmetric, as indicated by the skewness value close to zero (-0.03) and the moderate kurtosis (2.37), implying a moderately peaked distribution. Furthermore, the Jarque-Bera test confirms normality, with a high p-value (0.78), indicating that the output gap data closely resembles a normal distribution.

Money supply (MS) reflects the total amount of money circulating within the economy. With a mean money supply of approximately N14089.85b and a median of N9165.47b, it is evident that there was substantial variability in the amount of money in circulation, as indicated by the large standard deviation (14946.33). The positive skewness (0.82) suggests a right-skewed distribution, while the kurtosis (2.39) indicates a moderately peaked distribution. Although the Jarque-Bera test indicates a departure from normality with a p-value of 0.15, the deviation is not significant. Inflation (INF) measures the rate of price level increase in an economy, the data portrayed a highly right-skewed distribution, as indicated by the positive skewness (2.98). The kurtosis value (11.40) underscored the presence of extremely heavy tails and a highly peaked center, signifying substantial variability and deviation from a normal distribution. The Jarque-Bera test confirms this departure from normality, with a very low p-value (0.00), suggesting a significant departure from the expected distribution. The statistics of interest rate (INT) reveals relatively stable measures, with the mean and median interest rates hovering around 17.64 and 17.25 respectively. The slight positive skewness (0.11) and moderately heavy tails, as reflected in the kurtosis (3.14), indicate a distribution slightly departing from normality. However, the Jarque-Bera test suggests that the data closely approximate a normal distribution, with a high p-value (0.96), indicating a high likelihood of observing the data under normal circumstances.

Table 2 Descriptive Statistics

	OUG	MS	INF	INTR
Mean	-2.745864	14089.85	17.64244	172.5740
Median	-3.587111	9165.470	17.24625	141.1900
Maximum	10.89308	48462.07	24.77083	425.9800
Minimum	-16.34729	230.2900	11.48313	21.89000
Std. Dev.	7.443675	14946.33	3.031953	118.3422
Skewness	-0.030235	0.820953	0.111679	0.726399
Kurtosis	2.374984	2.385073	3.139647	2.573957
Jarque-Bera	0.492877	3.842490	0.086738	2.865167
Probability	0.781580	0.146425	0.957558	0.238691

Observations	30	30	30	30

Source: Author's Computation (2024)

The correlation table (Table 4.2) offers an overview of the relationships between various economic variables used in the analysis: the output gap (OUG), money supply (MS), interest rate (INT), and inflation (INF). Considering the relationship between the output gap and the money supply, the correlation coefficient of 0.370 indicates a weak positive correlation. This suggests that as the money supply increases, the output gap tends to widen, implying potential economic expansion. However, this correlation is not very strong, indicating that other factors beyond the money supply also influence the output gap. The correlation between the output gap and inflation is negative but weak, with a coefficient of -0.169. This suggests a slight negative relationship where as inflation increases, the output gap may narrow. While this correlation hints at a potential slowdown in economic growth as inflation rises, it is not significant enough to draw firm conclusions. The correlation coefficient of -0.426 found in the analysis for the relationship between the output gap and the interest rate reveals a moderate negative correlation. This suggests that as interest rates increase, the output gap tends to narrow. This relationship implies that monetary policy decisions, such as interest rate adjustments, can impact economic activity, with higher rates potentially curbing inflation but also stifling growth.

Examining the correlations involving the money supply, exchange rate, inflation and interest rate, variety of relationships emerged. For instance, a strong negative correlation between money supply and interest rate (-0.703) suggests that as the money supply increases, interest rates tend to decrease significantly. Additionally, the strong positive correlation between money supply and exchange rate (0.756) implies that as the money supply expands, the domestic currency appreciates against the foreign currency.

Table 3 Correlation Matrix

Correlation	OUG	MS	INF	INT
OUG	1.000000			
MS	0.370276	1.000000		
INF	-0.169098	-0.174775	1.000000	
INT	-0.425965	-0.703238	0.218243	1.000000

Source: Author's computation (2024)

In Table 3, the unit root test for each series in the study is presented. The result presented both the Augmented Dickey Fuller (ADF) and the Philip-Perron (PP) unit root tests. From the result presented, it is observed that the unit root test for all other series are stationary after second differencing, apart from inflation which is stationary at level. This result of the unit root test (of variables that are stationary at level and at first difference) makes the ARDL modelling technique suitable for this study.

Source: Author's Computation (2024)

Unit Root Test Results							
Augmented Dickey-Fuller (ADF)				Philip-Perron (PP)			Conclusion
LEVEL				LEVEL			
	Constant	Constant and Trend	None	Constant	Constant and Trend	None	
Exr	0.1603	-1.9412	1.6729	0.4611	-1.4749	2.6917	Not Stationary
Inf	-3.530**	-3.1141	-2.8042***	-5.3901***	-4.5419***	-2.842***	Stationary
int	-1.0489	-2.3096	-1.0963	-1.1454	-2.4526	-1.0798	Not Stationary
ms	0.0183	-1.0533	-0.8037	1.3971	-1.8052	3.5284	Not Stationary
oug	-0.9499	-0.8696	-1.5645	-1.2980	-1.3965	-1.2119	Not Stationary
Unit Root Test Results							
Augmented Dickey-Fuller (ADF)				Philip-Perron (PP)			Conclusion
LEVEL				LEVEL			
	Constant	Constant and Trend	None	Constant	Constant and Trend	None	
exr	-3.703***	-3.6440**	-3.0981***	-2.3128**	-2.8408	-3.040***	Stationary
Inf	-	-	-	-	-	-	-
int	-4.850***	-4.7969***	-4.8068***	-4.8418***	-4.7751***	-4.806***	Stationary
ms	-0.0489	-3.0296**	2.0510**	-4.7532	-13.5875***	-3.472***	Stationary
oug	-3.617**	-3.6465**	-3.6822***	-3.6077**	-3.5518	-3.676***	Stationary

Given that the variables in the series are of mixed order of integration, the study proceeded to test if there is any possible long-run combination of the variables

Table 4 Bounds Test of Cointegration

Test Statistic	Objective 1	Objective 2	Objective 3
F-stat	8.7873		6.4219
K	3		4
Critical Value bounds			
I0 Bound	4.01		3.47
I1 Bound	5.07		4.57

Source: Author's computation (2024)

From the result presented, it is observed that despite the mixed order of integration, there is a long-run combination of variables to meet objectives one to three. From the result presented in Table 4.1.4, the F-statistic across the models for objectives one to three is greater than both the upper and lower bound of the Bounds test.

To achieve the objective, the appropriate lag length was selected. From the result presented in Table 4.1.5, it is observed that the optimal lag length for the model is 3.

Table 5 Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-384.4117	NA	2317718.	28.84531	29.08528	28.91667
1	-254.6751	201.8124*	1027.995	21.08705	22.52687*	21.51518
2	-224.0611	36.28337	839.4246	20.67119	23.31086	21.45610
3	-188.0530	29.33993	704.1471*	19.85577*	23.69529	20.99746*
Note: Optimal lag length is 3, based on most of the decision criteria						
* indicates lag order selected by the criterion						

LogL: Log Likelihood; LR: Likelihood Ratio; FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwarz Information Criterion; HQ: Hanna-Quinn Information Criterion
Source: Author's computation (2024)

The objective of the study sought to analyse the impact of money supply on output gap. The first estimated model presented in Table 4.2.1is the result of the analysed relationship between money supply and output gap.

Table 6 Impact of Money Supply on Output Gap (2, 1, 1, 0 model)

	Short-run				Long-run			
Dependent Variable: Output gap (OUG) Variable	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
Lag output gap OUG(-1)	0.227590	0.142714	1.594730	0.127				
Money supply (MS)	-0.179318	3.489670	-0.05136	0.959	22.501593	2.9335	7.6706	0.000
Inflation (INF)	-0.094807	0.102397	-0.92587	0.366	0.029710	0.1525	0.1948	0.848
Interest (INT)	-0.089378	0.215450	-0.41484	0.683	-0.180351	0.4222	-0.4271	0.674
Trend	-1.963504	0.448512	-4.37782	0.000	-3.962065	0.6606	-5.9975	0.000
CointEq(-1)	-0.495576	0.096477	-5.13675	0.000				
R-squared	0.9648							
Adjusted R-squared	0.9499							
F-statistic	55.5380***							
Prob(F-statistic)	0.000000							
Durbin-Watson	4.2965							

Source: Author's computation (2024)

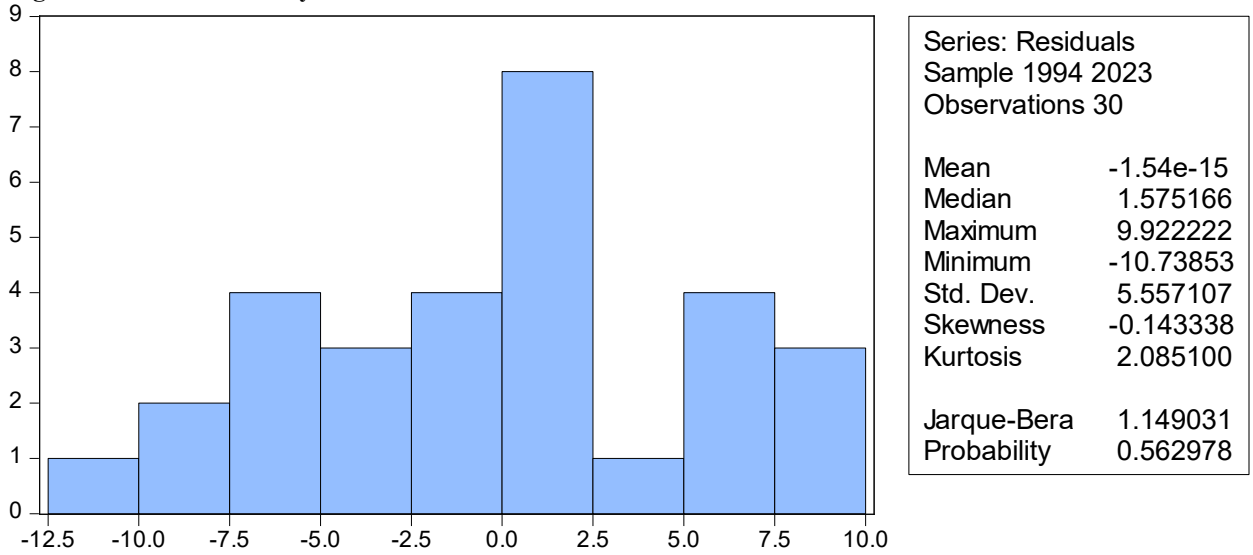
The result in Table 4.2.1 shows that in the short run, one-period lag in output gap exerted a positive effect on current output gap. The coefficient of 0.2276 suggested that one percent increase in the lagged output gap (from the previous period) is associated with an insignificant short-term rise in the current output gap by about 0.23 percent. This implies that recent increases in output gap have an immediate positive effect on current output gap. However, it is not statistically significant ($p>0.05$). On the other hand, the effect of money supply on output gap is negative. The coefficient of -0.1793 implies that one percent increase in short run money supply was associated with a fall in output gap of about 0.18

percent. This relationship actually lacks statistical significance (p>0.05). Furthermore, the effect of inflation on output gap is negative. From the result, it is observed that for every one percent rise in inflation, output gap fell by about 0.09 percent. This relationship is not statistically significant (p>0.05)

In addition, interest rate has a negative effect on output gap. From the estimated model, the negative coefficient of -0.089 indicated that one percent increase in interest rate is associated with about 0.09 percent decrease in output gap. This relationship is not statistically significant (p>0.05). The cointegration error correction term is negative and significant, further confirming the long run relationship existing among the variables. The error correction term of -0.4956 shows that when there is disruption in the system, about 49.6 percent of the previous equilibrium state will be recovered within a year.

In the long run, it is observed that money supply exerted a positive effect on output gap. From the estimate, the positive coefficient of 22.501593 suggests that one-percent increase in long run money supply was associated with 22.5 percent rise in output gap. However, this long run relationship has statistical significance (p<0.01). Furthermore, in the long run, inflation exerted a positive effect on output gap. From the result, for every one percent rise in inflation in the long run, output gap increased by about 0.03 percent. This effect is not shown to be statistically significant (p>0.05). The result of the estimated model further showed that in the long run, interest rate continued to exert a negative effect on output gap. The negative coefficient of -0.1804 implies that one percent increase in interest rate is associated with a long-term decrease in output gap by about 0.18 percent. This relationship is not statistically significant (p>0.05). It was observed that in both the short and long run, the coefficients for the trend term are negative and statistically significant (p <0.01), indicating a substantial negative trend in the output gap over time. The larger magnitude and statistical significance of this coefficient highlighted the importance of considering long-term trends in assessing the output gap's dynamics. The normality test is presented in Figure 4.1, given the non-significance of the Jarque-Bera probability (p>0.05), it is concluded that the residual term is normally distributed.

Figure 3 Test of Normality



Source: Author's computation (2024)

The serial correlation test result is presented in Table 7. From the result displayed, giventhat the probability of the chi-square statistics is not significant (p>0.05), it can be concluded that the residual term does not suffer from the serial correlation problems.

Table 7 Breusch-Godfrey Serial Correlation LM Test Result

F-statistic	0.437583	Prob. F(2,19)	0.6519
Obs*R-squared	1.232928	Prob. Chi-Square(2)	0.5398

Source: Author's computation (2024)

The heteroscedasticity test result is presented in Table 8. From the result displayed, given that the probability of the chi-square statistics is not significant (p>0.05), it can be concluded that the residual term is homoscedastic.

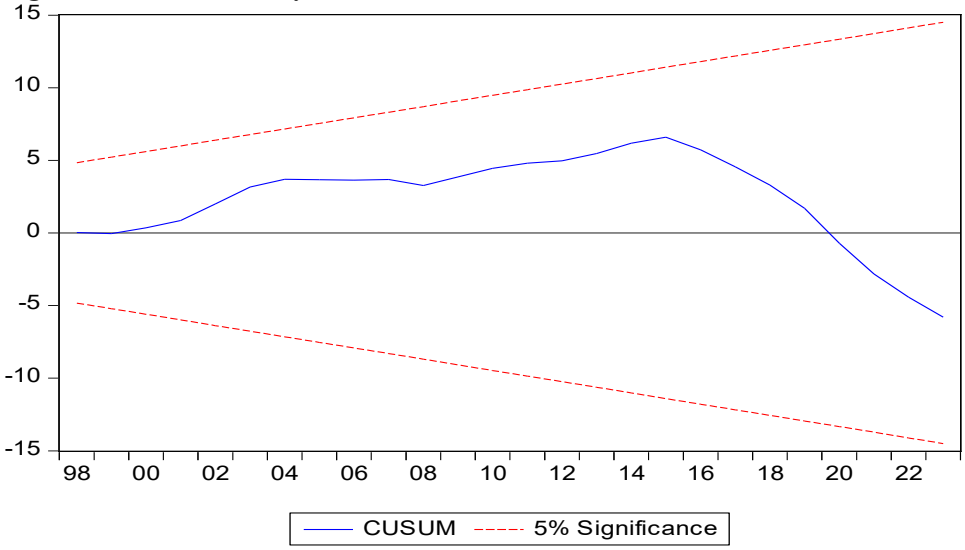
Table 8 Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.870210	Prob. F(3,26)	0.4691
Obs*R-squared	2.737407	Prob. Chi-Square(3)	0.4339
Scaled explained SS	1.115535	Prob. Chi-Square(3)	0.7733

Source: Author's computation (2024)

To test for the stability of the estimated parameters of the study, the cumulative sum (CUSUM) was carried out. Their result is presented in Figure 4.

Figure 4 CUSUM Stability Test



Source: Author's computation (2024)

From the stability test results, given that the CUSUM line lies within the 95% confidence intervals, it is concluded that the estimated parameters are stable.

Summary, Conclusion and Recommendations

An increase in money supply would shift the LM curve to the right, reducing interest rates and stimulating investment and consumption. This would lead to an increase in aggregate demand and output in the short run, resulting in a positive impact on the output gap. However, the insignificant coefficient suggests that the observed effect of money supply

on the output gap may be negligible or overshadowed by other factors; this is not in agreement with the findings of Babatunde and Shuaibu (2011) on the impact of money supply on output in Nigeria. In addition, the negative effect of inflation and interest rates on the output gap reflects the conventional IS-LM model's predictions, where higher inflation or interest rates dampen investment and consumption, leading to a decrease in output. Furthermore, the negative effect of money supply on the output gap in the short run reflects the conventional view of monetary policy transmission mechanisms. In economic theory, an increase in money supply typically leads to lower interest rates, stimulating borrowing, spending, and ultimately economic activity. However, the insignificant coefficient suggests that the short-term impact of monetary policy on output may be muted or overshadowed by other factors, such as expectations, fiscal policy, or external shocks. This is not in line with the short run statistically significant effect found by Yua (2022).

Similarly, the negative effects of inflation and interest rates on the output gap reflect conventional economic intuition. Higher inflation erodes consumers' purchasing power and reduces real incomes, leading to lower aggregate demand and economic output. Likewise, higher interest rates increase borrowing costs, dampening investment and consumption, thereby suppressing economic activity. However, the lack of statistical significance suggests that these short-term effects may not be robust or may be influenced by other factors not captured in the model.

In the long run, the impact of money supply on the output gap becomes more pronounced. This finding is in line with that of Irorember et al, (2021) where long run relationship between money supply and economic growth was found for Nigeria. In the IS-LM framework, an increase in money supply would lead to a shift in the LM curve, lowering interest rates and stimulating investment and consumption. However, in the long run, the output level is determined by factors such as technology, labour force, and productivity, represented by the full-employment level of output. Therefore, while an increase in money supply can temporarily boost output in the short run, it may not sustainably affect the output gap in the long run. The significant positive coefficient of money supply on the output gap indicates that over time, changes in money supply can have a substantial impact on increasing the output level. The significant positive effect of money supply on the output gap in the long run underscores the importance of monetary policy in shaping economic growth over extended periods. A higher money supply can fuel spending and investment, leading to increased economic output and employment. This finding aligns with the Keynesian perspective, which emphasizes the role of aggregate demand in driving economic activity.

The positive but statistically insignificant effect of inflation on the output gap in the long run suggests that while moderate inflation may be conducive to economic growth by stimulating spending and investment, excessively high inflation rates can distort resource allocation and undermine economic stability. Therefore, policymakers need to strike a balance between promoting economic growth and maintaining price stability.

The continued negative effect of interest rates on the output gap in the long run highlights the importance of monetary policy credibility and stability. Persistently high interest rates can deter investment and consumption, constraining economic growth potential. Therefore, policymakers must carefully manage interest rate policies to support sustainable economic expansion while keeping inflation in check. The presence of a substantial negative trend in the output gap over time raises concerns about the economy's long-term growth prospects.

Persistent negative trends may reflect underlying structural weaknesses, such as insufficient investment in infrastructure, education, or technology, as well as institutional barriers to economic development. Addressing these structural issues requires coordinated policy efforts aimed at improving productivity, enhancing competitiveness, and fostering innovation.

This study investigated the relationship between money supply, exchange rate, and output gap in Nigeria from 1994 to 2023. While exploring both short and long-term dynamics, several economic factors were observed to influence the output gap. Short-term analyses revealed a positive relationship between recent output gap increases and the current gap, with money supply and interest rates showing negative impacts, though not statistically significant. However, in the long run, money supply exhibited a significant positive association with the output gap, while inflation displayed a positive effect, albeit not statistically significant. The following recommendations are made based on the findings of the study. Given the insignificant short-term effects on the output gap and its significant positive (22.501593) association in the long run, there is a need to promote monetary stability. Policymakers should focus on maintaining prudent monetary policies to ensure stable money supply growth, which can positively influence economic output over the long term. Despite the statistically insignificant short-term impact of inflation on the output gap, its negative effect(-0.224209) in the long run warrants attention. Policymakers should implement measures to control inflationary pressures, such as prudent fiscal management and effective monetary policy tools, to mitigate its adverse effects on economic growth and stability. Despite the lack of significant short-term impact, interest rates (-0.069063) continued to exert a negative influence on the output gap, particularly in the long run. Policymakers should adopt flexible interest rate policies that respond to changing economic conditions, ensuring that interest rates remain conducive to economic growth while also considering inflationary pressures and exchange rate stability. However, the findings of this study contribute to the existing knowledge in several ways. The result of the analysis on the impact of money supply on output gap in the short run and long run will help policymakers make decisions regarding choice of monetary policy instruments. The persistent negative effect of exchange rate on output gap informs the government and policy makers the damage exchange rate depreciation has done to the growth of Nigerian economy.

References

1. Agu, C (2007): What does the Central Bank of Nigeria Target? An analysis of the monetary policy
2. Anyanwu, F; Ananwude, A & Okoye, N. (2017). Exchange rate and Nigerian economic growth: A granger causality impact assessment, International Journal of Applied Economics, Finance and Accounting 1(1), 1-13.
3. Anyanwu, J. & Oaikhenan, H. (1995).Modern Macroeconomic theory and applications in Nigeria. Onitsha, Diocessan Press.
4. Arestis, P. & Sawyer, M. (2008).A Critical reconsideration of the foundations of monetary policy in the new consensus macroeconomic framework, Cambridge Journal of Economics, 32(5), 761-779. https://doi.org/10.1093/cje/ben004
5. Babatunde, A., Abu, U., Ekpenyong, K & Christopher, E. (2016).Exchange rate fluctuation and economic growth, the Nigerian experience, International Research Journal of Finance and Economic Issue. 153

6. Babatunde, M. & Shuaibu, M. (2011).Money supply, inflation and economic growth in Nigeria.Asian African Journal of Economics and Econometrics, 1(1), 147-163.
7. Biswas A.(2014). The output gap and expected security returns. Review of financial economics xxx-xxx https://doi.org/10.1016/j.rfe.2014.04.001
8. CBN (2012): Monetary sector model for Nigeria. Research Department, Central Bank of Nigeria
9. Dingela, S. & Khobai, H. (2017).Dynamic impact of money supply on economic growth in South Africa; An ARDC approach. Nelson Mandela University Munich Personal Rep. Archive.
10. Gaspar, V., & Smets, F. (2002). Monetary Policy, Price Stability and Output Gap Stabilization. International Finance, 5(2), 193–211 https://doi.org/10.1111/1468-2362.00094
11. Grigoli, F., Herman A., Swiston, A., & Di Bella, G (2015). Output gap uncertainty and real-time monetary policy, Russian Journal of Economics 1(4), 329-358 https://doi.org/10.1016/j.ruje.2016.02.001
12. Iorember, P., Jelilov, G., Alymkulova, N & Gbaka, S (2021). Analysis of the impact of monetary policyshocks on domestic output growth in Nigeria: Evidence from dynamic ARDL and VECM tests. International Journal of Public Policy 16(1), 13-25 https://doi.org/10.1504/IJPP.2021.121955
13. Yua, P (2022).Reconsidering the nexus between monetary policy and economic growth in Nigeria: The role of interest rate, money supply and financial inclusion.International Social Science Journal 72(244), 339-351 https://doi.org/10.1111/issj.12324
14. Julia, D & Stuart, M (2014): The output gap, what is it, how can it be estimated and are estimates fit for policy makers' purposes? Economic commentary.
15. Justine, G & Julein, R (2021).Output gaps and financial cycle, European Central Bank. Euro System. No 2832
16. London, A. (1989). Inflation and adjustment policy in Africa, some further evidence; African Development Review. 1(1), 87-111. https://doi.org/10.1111/j.1467-8268.1989.tb00008.x
17. Luis, J & Anu, G (2018).A menu on output gap estimation methods. Journal of Policy Modelling 40(2),827-850. https://doi.org/10.1016/j.jpolmod.2017.03.008
18. Maitra, B. (2011). Anticipated money, unanticipated money and output variations in Singapore. Journal of Quantitative Economics, 9(11), 119-211.
19. Michaelides, P., & Milios, J. (2009). TFP change, output gap and inflation in the Russian Federation (1994–2006). Journal of Economics and Business, 61(4), 339–352. https://doi.org/10.1016/j.jeconbus.2008.10.001
20. Mrabet, Z., Alsamara, M., Mimouni, K., & Shikh Ebid, A. (2023). Can government expenditure help reconstruct the Syrian economy in the post-conflict period? evidence from the SVAR and nonlinear ARDL models. Applied Economics, 55(56), 6661-6675. https://doi.org/10.1080/00036846.2023.2165615
21. Nelson, E., & Nikolov, K. (2003). UK inflation in the 1970s and 1980s: the role of output gap measurement. Journal of Economics and Business, 55(4), 353–370. https://doi.org/10.1016/s0148-6195(03)00030-4
22. Nusair, S. A., & Olson, D. (2021). Asymmetric oil price and Asian economies: A nonlinear ARDL approach. Energy, 219, 119594. https://doi.org/10.1016/j.energy.2020.119594
23. Onanuga, A., Tella, S & Osoba, A (2016). Uncertainty of output gap and monetary policy making in Nigeria. Acta Universitutis Danubisus (Economica) 12(5)
24. Pedro, I & Adesina, G., (2022).Impact of monetary policy shocks on output gap in Nigeria. International Journal of Economics and Finance 14(9), 38-52 https://doi.org/10.5539/ijef.v14n9p38
25. Rafiq, S. & Mallick, K. (2008).The effect of monetary policy on output in EMU; a sign restriction approach.Journal of Macroeconomics, 30(1), 1756-1791 https://doi.org/10.1016/j.jmacro.2007.12.003
26. Satti, A., & Malik, W (2017). The unreliability of output gap estimates in real time. The Pakinstan Development Review, 56(3), 193-219. https://www.jstor.org/stable/44986415
27. Takiyi, K., TatsuyaO., Naoya, K & Kohei, M (2017): Methodology for estimating output gapand potential growth rate: An Update.Research and Statistics Department, Bank of Japan.
28. Valadkhani A. (2014). Switching impacts of the output gap on inflation.Evidence from Canada, the UK, and the US.International review of economics and finance. https://doi.org/10.1016/j.iref.2014.06.001
29. Zapodeanu, D. & Cociuba, P. (2010).Linking money supply with the gross domestic product in Romania, Annaies University Apulensis Series O economics, 12(1), 501-511.