The effect of Exchange Rate on Output Gap in Nigeria

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Abstract
Economic theory highlights that exchange rate volatility influences the divergence between actual and potential output levels. Despite basic facts in theories, policymakers and monetarists in Nigeria pay inadequate cognizance to the link between OUG and trends in Exr. On the other way round, in advanced countries, the efficacy of monetary policy tools on OUG has exhaustively been examined, with deductions guiding accurate economic and policy decisions. In a bid to address the gap in Nigeria, this paper scrutinizes the possible effects of Exr on the output gap from 1994 to 2023, using an ex-post facto research design. The study utilized annual time series data obtained from the Nigerian Bureau of Statistics, the CBN Statistical Bulletin and the World Bank's World Development Indicators. Autoregressive Distributed Lag (ARDL) technique was employed to analyse data based on its robustness and clarity in estimating relationships both in the short-run and long-run. Results of the findings revealed that fluctuations in Exr affected the OUG negatively both in the short-run (with coefficient -0.0745) and the long-run (with coefficient -0.1391); with statistical significance. This implies that instability in the exchange rate contributed to a wide output gap during the period considered. Sequel to these findings, this study inferred that effective exchange rate management and stable monetary supply policies are necessary to achieve sustainable output growth and forestall the output gap in Nigeria. The government needs to implement strategies that will stabilize the exchange rate and ensure its alignment with broader macroeconomic objectives.

***Keywords*:** Exchange Rate, Inflation, Money Supply, Interest Rate, Output Gap

Jel Classification: F31; E31; E51; E43; E32

Introduction
The reflection of an economy's levels of output usually determines its efficiency and the effectiveness of its monetary aggregates. The major concern of policymakers is the determination and actualization of the actual OUG which sometimes deviates from its potential in the face of business cycle fluctuations and other economic realities. Output gap, whether positive or negative is an

indicator for measuring economic performance but can be detrimental in underdeveloped and developing economies. It guides the implementation of monetary policy, serves as a gauge for evaluating inflationary pressures and economic conditions, as well as predicting output, escalation in the general price level and growth in money stock. Positive output gap may be inflationary, while negative gaps may impel recessions which can generate further inflationary problems. This often prompts monetarists and policymakers strive to maintain a zero output gap, making actual and potential output equal.

The Exr is a pertinent channel for monetary policy; its shocks may cause depreciation of the local currency, make domestic goods cheaper and promote exports. It can also reduce import and encourage demand for local output thereby encouraging employment and investment which will in turn stimulate growth in output. The interaction between Exr, output, and other monetary variables is complex. For instance, an increase in money supply can exert downward pressure on the Exr through effective import demand leading to currency depreciation. A reduction in the money supply can strengthen the exchange rate through reduced imports. Depreciation of currency can stimulate export competitiveness and higher export revenues but may engender inflationary pressures and spur high costs of import, hampering growth. On the other way round, currency appreciation can result in capital flight, reduced profits for Indigenous producers, reduced volume of money in circulation, raised lending rates, discouraged borrowing and investment, and cause a decline in output. This usually results in a negative output gap where potential output outshoots the actual output.

The attainment of zero output gap or output level close to potential output remains an impediment to policymakers and the effectiveness of monetary policy instruments. Effort at investigating the usefulness of output gap in Nigeria has been minimal. Furthermore, the implications of Exr fluctuations on output gap have not been thoroughly examined. Nigeria's economy still experiences weak oil and non-oil export earnings, and volatility in Exr. These factors exacerbate the output gap and diminish the value of the Naira. Historically, swings in Exr and MS have amplified variations in Nigeria’s output gap, with policymakers making moderate attempts to address these issues. While existing studies have employed output gap analysis to assess the efficacy of monetary policy and predict domestic inflation, the nexus between output gap and exchange rate remains inadequately analyzed. This gap is analysed by exploring how Exr fluctuations Nigeria's output gap. The null hypothesis is tested: Exr does not significantly affect output gap in Nigeria.

The study is arranged as follows; Introduction – deals with the background, problem statement, objectives, hypothesis, and delimitation of the investigation. Literature Review – this discusses conceptual, theoretical, and empirical perspectives. Methodology – details the research design, theoretical framework, and model specifications. Results and Discussion – provides pre- and post-estimation techniques, analysis, and key findings. Conclusion and Recommendations – summarizes the study's implications and proposes policy measures.

Figure 1: Trends of OUG in Nigeria

Figure 1 illustrates the trend of OUG. In early 1990s, it is indicated that actual output fell below potential output. This trend reversed in subsequent years, with positive output gaps signaling that the economy operated above its potential level. The return of negative output gaps in 2010 reflected underutilization of resources and declining economic performance, coinciding with reduced oil prices and political instability. However, by the late 2010s and early 2020s, positive output gaps re-emerged, indicating improved economic performance. Although recent years have generally maintained positive gaps, fluctuations persist, suggesting varying alignment with potential output levels.

Figure 2: Exchange Rate in Nigeria (1994-2023)

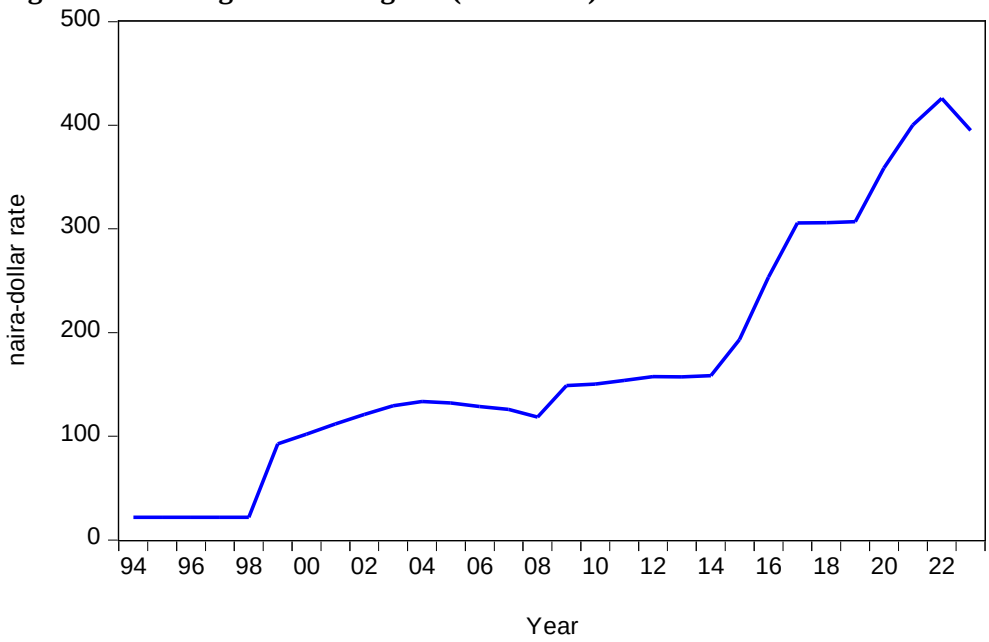

Figure 2 highlights Nigeria's exchange rate trends over the same period. Stability characterized the early 1990s due to consistent oil revenues and controlled foreign exchange policies. Deregulation in the late 1990s introduced significant volatility as market forces increasingly influenced the exchange rate. Nigeria's reliance on oil exports meant that fluctuations in global oil prices had a direct impact on the Naira's value. High oil prices strengthened the Naira, while low prices weakened it. Various administrations implemented policies such as currency devaluation and foreign exchange stabilization to manage these fluctuations.

Literature Review

OUG shows the percentage deviation of actual output from potential output. Potential output is the output an economy can produce when all resources have been fully employed, devoid of short-term economic fluctuations (Downes & Moore, 2007). The new Keynesian theory of business cycles frames the OUG as the deviation of output from its equilibrium level, assuming the absence of nominal rigidities. Pedro and Adesina (2022) emphasized the utility of output gap analysis in forecasting monetary variables such as exchange rates. Policymakers frequently rely on the output gap to assess economic conditions (Grigoli et al., 2015). However, challenges in measurement errors and the diversity of methods for estimating potential output have fueled extensive academic inquiry.

Exr, defined as the price of one currency relative to another, serves as a critical link between domestic and international prices of goods and services. It influences trade flows, capital movements, balance of payments, interest rates, and overall price levels. Appreciation occurs when fewer units of domestic currency exchange for one unit of foreign currency, while depreciation involves the opposite (Keneth et al., 2016). Exchange rates also reflect a country's economic strength, determined primarily by market forces of demand and supply (Ahmed & Zarma, 1997). In Nigeria, exchange rate is the amount of naira required to buy one unit of foreign currency in the foreign exchange market which is determined by the forces of buying and selling in the midst of fluctuations shaped by crude oil earnings, trade liberalization policies, and foreign capital flows (Campbel, 2010; Umeora, 2010). Exchange rate movements often impact key monetary variables such as money supply, interest rates, and trade balances. These mechanisms emphasize the importance of exchange rate in enhancing economic growth and stability. For instance, exchange rate appreciation or depreciation suggests the strength or weakness of a currency and measures the standard of a country's industrial competitiveness in the global market (Razazadech-Kersalari et al., 2014). The performance of an economy is disrupted when exchange rate deviates from equilibrium over time.

Nigeria adopted the fixed exchange rate system before the introduction structural adjustment programme in 1986, managed floating exchange rate regime in 2016 and transitioned to willing buyer, willing seller model in 2023 to allow market forces determine the exchange rate. Exchange rate stability boosts production, promotes exports and output growth. However, its shocks may be detrimental to the economy due to excessive demand for foreign currencies and inadequate foreign capital inflows. Quite a number of studies have investigated the relationship between output and exchange rate. Agenor (1991) examined real exchange rate depreciation and output growth across 23 developing countries, finding that depreciation boosted growth. Conversely, Morley (1992) observed that real exchange rate depreciation reduced output in 28 devaluation episodes.

Stotsky et al. (2012) analyzed foreign exchange regimes in East Africa, revealing that investment and real exchange rates significantly influenced output. Similarly, Berument et al. (2012) found mixed evidence on exchange rate shocks and macroeconomic performance in Turkey using a Vector Autoregressive (VAR) model. Ahmad (2017) highlighted the role of output gap and economic policy uncertainty in explaining stock market variations in emerging markets. Using

VAR, Kamaan (2014) found no significant impact of monetary policy on output growth in Kenya.

Usman (2007) employed cointegration and error correction models to examine the relationship between exchange rate misalignment and macroeconomic performance in Nigeria, and inferred that real exchange rate misalignment contributed to import dependence in the 1970s and 1980s. Akpan and Atah (2012) found no strong direct link between exchange rate changes and output growth but identified monetary variables as significant drivers. Rasaq (2012) demonstrated that exchange rate volatility positively influenced GDP, recommending enhanced export diversification and reduced petroleum sector reliance. Akani (2016) and Babatunde et al. (2016) confirmed long-run relationships between exchange rates and output. Pedro and Adesina (2022) used ARDL and Differenced OLS to underscore the critical role of exchange rates in shaping Nigeria's output levels. Their findings align with studies advocating exchange rate stability to support macroeconomic performance.

Research Methodology

This paper explored the impacts and effect of exchange rate dynamics on output gap in Nigeria from 1994 to 2023. Secondary data on exchange rate, money supply, inflation, and interest rate, sourced from CBN Statistical Bulletin were used. The actual output was proxy with annual time series data on Gross Domestic Product (GDP), while the potential output was estimated using the Hodrick-Prescott Filter on EViews 9. The exchange rate was measured in terms of naira per US dollar. M2 which is the currency with the public, and demand and time deposits of the commercial banks was used to capture money supply. Inflation was proxy with consumer prices in annual percentage changes, and the lending rate was employed as the measure of interest rate.

This study assessed the output gap, exchange rate and the relationship between these two macroeconomic and monetary variables. The output gap is expressed as the difference between actual output and potential output. Actual output is the total volume of goods and services produced in an economy in a given year. The potential output cannot be observed directly, it can only be estimated. In this paper, its estimation was conducted using Gross Domestic Product (GDP) data, processed through the Hodrick-Prescott (HP) filter on EViews 9. Mathematically output gap is expressed as:

$$OUG = \frac{Aual - Ptial}{Ptial} \times 100 \quad (1)$$

where

Oug = output gap, Aual is the actual output while Ptial is the potential output level

$$OUG = \frac{Aual - Ptial}{Ptial} \times 100$$

Autoregressive Distributed Lag model (ARDL) was employed to analyse data. Output gap can be expressed as:

$$OUG_t = \beta_0 + \beta_1 EXR_t + \beta_2 MS_t + \beta_3 \Delta INF_t + \beta_4 INT_t + \varepsilon_t \quad (2)$$

$$\Delta OUG_t = \beta_0 + \beta_1 \sum_{i=1}^{n} \Delta \ln EXR_{t-i} + \beta_2 \sum_{i=1}^{n} \Delta \ln MS_{t-i} + \beta_3 \sum_{i=1}^{n} \Delta INF_{t-i} + \beta_4 \sum_{i=1}^{n} \Delta INT_{t-i} + \varepsilon_t \quad (3)$$

where *EXR* is the exchange rate, MS is the money supply, INF is inflation, INT is the rate of interest and ε_t is the stochastic variable. Descriptive statistics was conducted to ascertain the maximum, mean, median, standard deviation, skewness, kurtosis, Jarque-Bera and probability of the variables under study.

Result and Discussion

In this section, outcomes of the econometric analysis, discussion and subsequent interpretation of the data collected to accomplish the research goals that are stated. The last part of the paper is a discussion of the result while making a comparison of the result vis-à-vis other previous studies and existing theories. The chapter covers three categories of results comprising pre-estimation, empirical analysis and post-estimation results.

Table1: Descriptive statistics

	OUG	EXR	INTR	INF
Mean	-0.001565	84.07014	15.83095	18.64122
Median	-0.005445	21.94563	16.85859	12.77549
Maximum	0.235483	358.8108	31.65000	72.83550
Minimum	-0.163470	0.546781	6.000000	5.388008
Std. Dev.	0.089819	99.20484	5.909692	15.79478
Skewness	0.309273	1.108346	0.053971	1.905539
Kurtosis	2.829913	3.389955	2.680635	5.750373
Jarque-Bera	0.823059	10.13157	0.227290	44.17773
Probability	0.662636	0.006309	0.892575	0.000000
Sum	-0.075114	4035.367	759.8855	894.7785
Sum Sq. Dev.	0.379171	462555.2	1641.450	11725.34

Source: Authors' Compilation, 2024

The mean of output gap is close to zero, indicating that the Nigerian economy operated near its potential. The negative skewness suggests more frequent negative output gaps, indicating periods of economic contraction. The low kurtosis value indicates a relatively moderate distribution of output gaps. The low kurtosis value indicates a less pronounced distribution shape. The mean exchange rate is 84.07014, indicating the average value of the Nigerian currency against other currencies. The positive skewness suggests a skew towards lower exchange rate values. The high kurtosis value indicates a distribution with heavy tails, implying a larger likelihood of extreme Exr movements. The mean of interest rate is 15.83095, indicating the average cost of borrowing or lending in the Nigerian economy. The near-zero skewness suggests a relatively symmetrical distribution of interest rates. The moderate kurtosis value indicates a distribution with slightly heavier tails. The mean inflation rate is 18.64122, reflecting the average increase in the general price level. The positive skewness suggests a skew towards higher inflation values. The high kurtosis value indicates a distribution with heavy tails, indicating a higher likelihood of extreme inflation values.

The Jarque-Bera statistics for the output gap is 0.823059 with a corresponding probability of 0.662636. The Jarque-Bera statistics for the exchange rate is 10.13157 with a probability of 0.006309. The low probability indicates that the null hypothesis of a normal distribution for the exchange rate is rejected, suggesting that the distribution deviates significantly from normality. The Jarque-Bera statistics for the interest rate is 0.227290 with a probability of 0.892575. Since the probability is high, the null hypothesis of a normal distribution for the interest rate is accepted. The Jarque-Bera statistics for inflation is 44.17773, with

a probability of 0.000000. Inflation is not normally distributed; implying that the distribution of inflation in Nigeria deviates from normality. It is also obvious from the result of Jarque-Bera statistics that the distribution of the exchange rate in the period considered significantly differs from a normal distribution. This indicates the presence of non-normal characteristics that need to be checked during economic analyses and policy-making.

Table 2: **Unit Root Test Results**

Specifications	Variables	ADF t-statistics		PP Adj.t-statistics		Order
		Level	**First Diff.**	**Level**	**First Diff.**	
None	OUG	-2.2675	-3.8751	-2.2217	-2.2011	I(0)
		(0.0240)	(0.0002)	(0.0267)	(0.2086)	
	MS	-0.0774	-5.7502	-0.0685	-2.0375	I(1)
		(0.6517)	(0.0000)	(0.6549)	(0.2703)	
	EXR	2.8686	-3.0778	3.8532	2.4875	I(1)
		(0.9989	(0.0028)	(0.9999)	(0.0000)	
	INTR	-0.3368	-5.8702	-0.3902	-1.3957	I(1)
		(0.5595)	(0.0000)	(0.5382)	(0.8497)	
	INF	-2.1459	-7.4364	-2.0938	-3.7947	I(0)
		(0.0320)	(0.0000)	(0.0361)	(0.0254)	
Intercept	OUG	-2.2463	-3.8333	-6.4782	-6.4149	I(1)
		(0.1934)	(0.0050)	(0.0000)	(0.0000)	
	MS	-1.85913	-5.7080	-7.2926	-7.2508	I(1)
		(0.3482)	(0.0000)	(0.0000)	(0.0000)	
	EXR	1.96069	-3.8206	-3.7350	-0.1293	I(0)
		(0.9998)	(0.0053)	(0.0004)	(0.9928)	
	INTR	-1.8229	-5.8268	-7.5984	-7.7338	I(1)
		(0.3652)	(0.0000)	(0.0000)	(0.0000)	
	INF	-4.0212	-7.3526	-6.6430	-6.4969	I(0)
		(0.0029)	(0.0000)	(0.0000)	(0.0000)	
Trend and intercept	OUG	-2.2296	-3.7939	-2.2675	-6.3191	I(1)
		(0.4627)	(0.0258)	(0.4428)	(0.0000)	
	MS	-2.2522	-5.6902	-2.3938	-7.1809	I(1)
		(0.4508)	(0.0001)	(0.3760)	(0.0000)	
	EXR	-0.3287	-4.8646	-0.1293	-5.2022	I(1)
		(0.9874)	(0.0015)	(0.9928)	(0.0005)	
	INTR	-1.2573	-6.1961	-1.3957	-7.7338	I(1)
		(0.8862)	(0.0000)	(0.8497)	(0.0000)	
	INF	-4.2108	-7.2478	-3.7947	-6.4969	I(0)
		(0.0089)	(0.0000)	(0.0254)	(0.0000)	

Source: Authors' Compilation, 2024

In the unit root statistics conducted, all the variables exhibit evidence of stationarity in the order of I(1) which means they are not stationary at level. Stationary variables are pertinent in economic analysis for more reliable modelling and forecasting.

Table 3: ARDL Bounds Test

T-Statistic	F-statistic	K
	5.061328	4
Critical Values	**I0 Value**	**I1 Value**
Significance: 5%	2.86	4.01

Source: Authors' Compilation, 2024

The test statistics value of 5.061328 is compared to the critical value bounds at a 5% significance level. The critical values for the I(0) bound and I(1) bound are 2.86 and 4.01, respectively. Since the test statistics value exceeds both critical values, the null hypothesis was rejected.

Table 4: Lag Order

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-643.3198	NA	4324195.	29.46908	29.67183	29.54427
1	-485.5976	272.4292*	10461.10*	23.43626*	24.65275*	23.88739*
2	-463.5656	33.04812	12530.30	23.57116	25.80140	24.39824
3	-447.2011	20.82747	20923.72	23.96369	27.20767	25.16671
4	-416.0355	32.58221	20247.48	23.68343	27.94116	25.26240

Source: Authors' Computation, 2024

The lag order criterion gives the appropriate lags to capture temporal dependencies in the data. By selecting an optimal lag order, the model can potentially capture the dynamics and relationships among the variables. The selected lag order by the criterion is lag 1, indicated by the asterisk (*) symbol. This means that the lag 1 model provides the best fit according to the selected criterion.

Table 5: Effect of Exchange Rate on OUG in Nigeria

	SR				LR			
Variable	Coeff-icient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Stat-istic	Prob.
OUG (-1)	0.3479	0.1617	2.1522	0.0438				
EXR	-0.0745	0.0223	-3.3340	0.0033	-0.1390	0.0209	-6.638	0.0000
INTR	0.3966	0.2197	1.8054	0.0861	0.7402	0.4597	1.6102	0.1230
INF	0.0439	0.1283	0.4242	0.7356	1.1321	0.1817	1.1322	0.2709
Trend	1.3628	0.3737	3.6466	0.0016	2.5436	0.3099	8.2082	0.0056
IntEq(-1)	-0.5357	0.1462	-3.6647	0.0015				
R^2	0.9452							
Adj R^2	0.9260							
F-statistic	49.2476***							
F-stat	0.0000							

Source: Authors' compilation (2024)

ExR negatively impact the output gap (-0.0745), suggesting that a stronger currency reduces net exports, subsequently narrowing the output gap. This occurs because an appreciation of the domestic currency makes exports less competitive in international markets and imports cheaper for domestic consumers, thereby dampening net exports and aggregate demand. Conversely, the positive implication of interest rates (0.3966) on the output gap indicates that higher interest rates may promote economic activity by reducing borrowing costs and encouraging investment.

In the long run, Exr(-0.1390) impacted OUG negatively as well, indicating that exchange rate fluctuations have enduring impacts on economic performance. This finding aligns with Morley (1992), where real exchange rate depreciation reduced output, but it contradicts studies such as Adeniran et al. (2011), Azeez et al. (2014), Ade-Philips (2014), and Pedro and Adesina (2022), which reported a positive long-run effect of exchange rates on output or the output gap in Nigeria. A stronger exchange rate may reduce the output gap by decreasing the competitiveness of domestic goods in international markets, thus constraining export-led growth and overall economic expansion.

The positive long run output gap effects of interest rates and inflation suggest that higher interest rates and moderate inflation can sustain economic activity over extended periods. This relationship may result from the stimulatory effect of interest rates on investment and the influence of inflation on consumer spending. However, the lack of statistical significance in these results highlights the potential role of other factors, such as productivity growth and structural reforms,

in driving long-term economic expansion. The non-significance of Intr on the OUG contrasts with the findings of Mukhtar and Muhammed (2017), who reported a positive long-run impact of interest rates on growth. The normality test carried out and presented shows that the P-value (0.6089) at 5% level of significance signifies normally distribution of the residual term.

Conclusion and Recommendations

This paper examined Exr and OUG, emphasizing its relevance in light of the country's current economic challenges, including exchange rate volatility and output fluctuations. The findings revealed that exchange rates had an insignificant relationship with the output gap. Consequently, the study recommends that policymakers develop and implement effective exchange rate management strategies and stable monetary policies to minimize the output gap and promote sustainable economic growth in Nigeria.

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