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Transmission of Monetary Policy via the Interest Rate and Money Supply to Real Sector Output in Nigeria

Mustapha Musa Kuta
Alfa Yakubu
Mike Duru
Ayodeji Salihu
A.A. Alexander
Jude Ikubor

Department of Economics
Nigerian Defence Academy, Kaduna, Kaduna State, Nigeria
Corresponding Author: Mustaphamkuta@gmail.com

Abstract

This study examines the effectiveness of monetary policy transmission channels and their impact on real sector output in Nigeria from 1980 to 2023. Using Non-linear Autoregressive Distributed Lag (NARDL) Model. Findings of the F-Bound test of the NARDL model revealed that there exists a long-run relationship between monetary transmission channels and real sector output. The results of the joint asymmetries using the Wald test revealed that there exists an asymmetric effect of transmission channels on real sector output both in the short run and long run. Additionally, the findings of the model revealed that in the long run increase in interest rate has a negative and insignificant impact on real sector output in Nigeria whilethe decrease in interest rate has a positive and significant impact on real sector output in Nigeria. That is, lower interest rates enhance credit flow, especially to the major real sectors. Positive exchange rates, asset prices and money supply have a positive and significant impact on real sector output. By implication, a growing money supply enables businesses and households to access more funds from financial institutions through loans and investments. In the short run, a positive interest rate has a negative and insignificant impact on real sector output while a negative interest rate has a positive and significant impact on real sector output. Positive exchange rates and negative exchange rate hasa negative impact on real sector output but are significant for positive exchange rates. In addition, positive asset prices and money supply have a positive and significant impact on real sector output. However, negative asset prices and money supply have a negative and insignificant impact on real sector output. Based on the findings, the study

recommends that the Central Bank of Nigeria should adopt an integrated policy framework by harmonizing monetary policy tools to channel funds to high-growth sectors while promoting export incentives and investor confidence, which would drive sustainable real sector growth in Nigeria.

Keywords: Monetary Policy, Monetary Transmission Channels, Real Sector Output and NARDL

1. Introduction

Monetary policy is one of the tools used to stabilize the economy both in the developed and in the developing countries. Its objectives, on a global scale, include maintaining price stability,

controlling inflation, stabilizing the financial system, and promoting sustainable economic growth. In most developing countries, however, the primary objective of monetary policy is to achieve price stability (low inflation) and sustainable economic growth. The objective of price stability is attained through the contractionary monetary policy mechanism. The mechanism reduces the supply of money within an economy by lowering the prices of bonds and raising interest rates. Thus, consumption falls, prices fall and inflation slows down. A contractionary monetary policy is one common method of managing inflation (Alfa & Alexander, 2024). On the other hand, the objective of sustainable economic growth is achieved through an expansionary monetary policy mechanism. Expansionary monetary policy, according to Keynesians, increases the supply of loans that are accessible through the banking system, leading to falling interest rates.

At lower interest rates, total investment costs and interest-sensitive consumer goods tend to increase, thereby increasing real GDP in the economy. An increase in real GDP, other things being equal, is expected to translate into economic growth at least within the short run. However, for economic growth to be sustainable in the long run, growth in real sector output must be enhanced. The key sectors that make up the real sector of an economy according to Adebayo (2013) are the primary sector consists of Agriculture and Mining, the secondary sector consists of manufacturing, building and construction and the tertiary sector consists of services and commerce.Households and profit institutions are also part of the real sector. In this sense, farmers harvesting their crops and textile mills converting raw cotton into fabricsare included inthe real sector of an economy.

The channel of monetary policy transmission plays a vital role in real sector output. The monetary policy transmission is the process by which asset prices and general economic conditions are affected as a result of monetary policy decisions (Alfa, 2020). Such decisions are intended to influence the aggregate demand, interest rates, and amounts of money and credit to affect overall economic performance.The transmission channels are the media that pass monetary policy impulses from the point of action to the target objective (Alfa & Haladu, 2023). The target objective is either to accelerate the growth of real sector output or to reduce inflation. Cevik and Teksoz (2012) also emphasize that the channels of monetary transmission provide the monetary authorities with knowledge for better decision-making. Therefore, once policymakers understand the operations of the different channels, they will always make decisions that better address significant macroeconomic challenges.

The debate on the efficacy of the transmission channel of monetary policy in enhancing real-sector output has attracted substantial theoretical and empirical efforts (Afrin, 2017). For instance, the Keynesians argued that output shortage (which could lead to inflation) results from the disequilibrium of aggregate demand and supply and requires fiscal policy measures. On the other hand, monetarists posit that the disequilibrium of aggregate demand and supply can be resolved via monetary policy measures such as changes in money supply, interest rate and reserve requirements. Although considerable studies have examined the interest rate, the exchange rate, and credit transmission channels over the years, the subject of what channel of transmission is better than others is still highly controversial (Sa'ad *et al.,* 2016). One reason for the controversy is the non-existence of a single transmission channel independent of others. In other words, monetary policy signals are passed on to the economy through different but interrelated channels. However, due to a collinear relationship among these channels, ascertaining their separate impacts on real sector output can be challenging. It is against this

backdrop that this study examines the impact of monetary transmission channels on real sector output in Nigeria from 1980 to 2023.

2. Literature Review

Conceptual Review

Monetary policy transmission channels are several ways in which monetary policy transmission affects the real economy like Nigeria and also the price level. Four channels operate in market economies which are, interest rates, credit, exchange rate and other assets (Uma, Ogbonnaya & Paul, 2015). Similarly, CBN (2017) viewed monetary transmission channels as a set of channels through which monetary policy influences the real economy, particularly output and inflation. Additionally, Lorenzo (2001) described monetary transmission as a set of channels or specific ways through which monetary policy actions of the central bank impact the ultimate objectives of inflation and output.

Real Sector

The real sector is the sector that involves the production of goods and services used in the economy. It has been the engine of economic transformation in Nigeria over the years. To achieve 80% economic growth in Nigeria, the government should give preference to the service, agriculture and industry sectors in the formulation of policies for economic growth (Rasheed (2020).Similarly, Anyanwu (2010) defined the real sector as a sector that deals with the production, acquisition, and movement of commodities and services in an economy. The real economy is critical and essential for the overall development of the country. It provides several advantages to the country as it has been determined to have the greatest influence on that country's economic development and job creation.Oka and Adesola (2017) conceived the real sector as a vehicle that drives economic growth and development.

This implies that no economy can survive without a vibrant real sector. This is because of the role it plays in generating employment opportunities, building capacity, enhancing export and foreign exchange earnings and producing and distributing goods and services to meet the demand of the economy. In the view of Stephen and Olufemi (2015), the real sector is the sector where goods and services are produced through the combined utilization of raw materials and other production factors such as labour, land and capital. Broadly speaking, the real sector has been categorized into agriculture, industry, building and construction, and services.

Theoretical Framework

The study adopts the Keynesian Monetary Theory espoused by John Maynard Keynes in 1936 as a guide. The theory is part of the broader economics and it posits that individuals not only hold money for transactions but also investments in assets (such as bonds) to avoid variation that may arise from interest rate instability. Nigeria is an emerging economy and lacks adequate financial resources to command accelerated growth and development due to the developing nature of the financial system, especially the stock market. Considering the assumption of the theory, when individuals invest idle funds, resources are mobilized from surplus units to deficit units which spurs real output. Profits yielded from investments improve the welfare of the people and the resultant effect is increased consumption of desired goods and services. The rise in consumption ultimately results in increased domestic production which is well matched by the activities of the real sector. Due to the upbeat in domestic consumption, the real sector of the economy will

witness sustained growth. The theory is based on the aggregate demand and aggregate supply interactions. A discretionary change in monetary policy affects the economy through two sides of monetary policy, the demand and supply sides. From the aggregate demand side monetary policy is directed through three channels; the exchange rate, the interest rate and other assets and indirectly through the credit bank channels.

Empirical Review

Alfa *et al*. (2023) analyzed the impact of interest rate channels of monetary transmission on real sector output in Nigeria from 1980 to 2021, using the Non-linear Autoregressive distributed lag (NARDL) model. The result showed that interest rate and inflation rate negatively impacted real sector output in Nigeria. Also, Asset price and exchange rate positively impacted real sector output. Mussa (2023) investigated the relative efficacy of monetary policy transmission on economic growth in Tanzania from Jan 2020 to September 2022, using a co-integration and error correction modelling approach to analyze the short-run and long-run comparative effects of five monetary policy transmission mechanisms on economic growth. The study found that the growth effects of monetary policy depend on transmission channels. The results also showed that the interest rate channel and stock price channel are not effective in Tanzania. The results further revealed that though the bank credit channel is working, it is weak. Moreover, the results revealed that the exchange rate and expected inflation are the dominant transmission channels of monetary policy in Tanzania.

Thankgod and Igbinovia (2022) examined Nigeria's real sector performance with monetary policy tools from 1981 to 2020, using ARDL cointegration bound test to determine the long-run connection between the variables utilized. The results' findings demonstrated that there exists a long-run relationship between real sector performance and monetary policy tools in Nigeria. It also demonstrated that the monetary policy tools have a short-term impact on Nigeria's real sector production.Ibbih, Anzaku, Ogwuche and David (2020) investigated the effect of monetary policy on manufacturing value-addition in Nigeria from 1981 to 2018, using Autoregressive Distributed Lag (ARDL) model for estimation. The study revealed that in the short run; only a broad money supply majorly drives the growth of manufacturing value-addition in Nigeria. However, the long-run significant driver of manufacturing value-addition in Nigeria is largely from manufacturing sector credit.

Le, Van and Bao (2019) analyzed the relationship between monetary policy, exchange rate and consumption expenditure in Vietnam and the European Union from April 2001 to October 2017, using the non-linear ARDL model. The NARDL estimation results strongly acknowledge the importance of USD as vehicle currency when more significant short-run and long-run coefficients are found. Particularly, the USD/VND movement was found to affect not only the Vietnam-USA but also the Vietnam-EU and Vietnam-UK trade balance. In addition, VND appreciation against USD seems beneficial to Vietnam’s bilateral trade with the EU plus the UK. Osakwe, Ibenta, and Ezeabasili (2019) examined the impact of monetary policy in Nigeria on the manufacturing sector from 1986 to 2017, using the Autoregressive Distributive Lag (ARDL) model. The results showed that there is only a short-term influence on Nigeria's manufacturing sector output from monetary policy instruments. As a short-term policy instrument, treasury bills and the money supply might be used in Nigeria's industrial sector.

Egbulonu (2018) investigated the impact of Nigeria's monetary policy on the rise of the manufacturing sector from 1980 to 2016, using the Autoregressive Distributive lag model to

calculate both short- and long-term versions of the model and Bounds test for cointegration for long run relationship. The results showed that the factors have a long-term with the dependent variable. The results showed that the availability of money has both a short- and long-term positive and significant impact on Nigeria's industrial output. Although it was not statistically significant, the short and long-term exchange rates were both negative. Interest rates had a small but positive impact on industrial production, even if they were excellent for the short and long terms.

Ezeaku et al (2018) examined the impact of monetary policy transmission channels on industry performance in Nigeria from 1981 to 2014, using the error correction model and Johansen cointegration technique. Three explanatory variables were used as channels of monetary policy transmission, being bank channel (private sector credit), interest rate channel (real lending rate) and exchange rate channel, while the dependent variable was the real output; measured as the contribution of the industrial sector to GDP. The result found a long-run relationship between monetary policy and industrial output. However, an insignificant negative effect exists between all the monetary policy transmission channels and industry performance.

3. Methodology

Model Specification

Non-linear Autoregressive Distributed Lag (NARDL) Model

To achieve the objective of this study, the study adopted the NARDL model credited to Shin, Yu and Greenwood-Nimmo (2014). The model was adopted from the work of Le *et al.* (2019) but differs from those of the authors in the choices and measurements of variables of the model. The NARDL model has the capacity to show how the expansionary monetary policy (positive) and contractionary monetary policy (negative) impact, simultaneously, on real sector output. The choice of the NARDL model was to overcome the problem of discrimination in the order of integration of variables imposed by most models as well as the problem of linearity restrictions imposed by most standard linear models (classical co-integration models, the error correction models), despite recognizing the nonlinearity of many macroeconomic variables over the years (Shin, Yu & Greenwood-Nimmo, 2011).

The functional form of the model for this study is specified as:

RSO = f (INT, EXR, ASP, M2) ..... (1)

Where RSO = Real sector output, EXR= Exchange rate, ASP = Asset price and M2 = Money supply.

The positive and the negative partial sums are defined formally as:

$$\boldsymbol{POS} = \mathbf{lINTt+} = \sum_{j=1}^{t} \boldsymbol{\Delta}\mathbf{lnINT}_{j+} = \sum_{j=1}^{t} \boldsymbol{max}(\boldsymbol{\Delta}\mathbf{lnINT}_{j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{2})$$

$$\boldsymbol{NEG} = \mathbf{lnINTt-} = \sum_{j=1}^{t} \boldsymbol{\Delta}\mathbf{lnINT}_{j-} = \sum_{j=1}^{t} \mathbf{min}(\boldsymbol{\Delta}\mathbf{lnINT}_{j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{3})$$

$$\boldsymbol{POS} = \mathbf{lnEXRt+} = \sum_{j=1} \boldsymbol{\Delta}\mathbf{lnEXR}_{j+} = \sum_{j=1} \boldsymbol{max}(\boldsymbol{\Delta}\mathbf{lnEXR}_{j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots (\mathbf{4})$$

$$\boldsymbol{NEG} = \mathbf{lnEXRt}- = \sum_{j=1}^{t} \boldsymbol{\Delta lnEXR_{j-}} = \sum_{j=1}^{t} \boldsymbol{min}(\boldsymbol{\Delta lnEXR_j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{5})$$

$$\boldsymbol{POS} = \mathbf{lnASPt}+ = \sum_{j=1}^{t} \boldsymbol{\Delta lnASP_{j+}} = \sum_{j=1}^{t} \boldsymbol{max}(\boldsymbol{\Delta lnASP_j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{6})$$

$$\boldsymbol{NEG} = \mathbf{lnASP}t- = \sum_{j=1}^{t} \boldsymbol{\Delta lnASP_{j-}} = \sum_{j=1}^{t} \boldsymbol{min}(\boldsymbol{\Delta lnASP_j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{7})$$

$$\boldsymbol{POS} = \mathbf{lnM2t}+ = \sum_{j=1}^{t} \boldsymbol{\Delta lnM2_{j+}} = \sum_{j=1}^{t} \boldsymbol{max}(\boldsymbol{\Delta lnM2_j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{8})$$

$$\boldsymbol{NEG} = \mathbf{lnM2}t- = \sum_{j=1} \boldsymbol{\Delta lnM2_{j-}} = \sum_{j=1} \mathbf{min}(\boldsymbol{\Delta lnM2_j}, \mathbf{0}) \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{9})$$

Equations 2 - 9 can then be used to derive the nonlinear ARDL model of estimating the impact of monetary policy transmission channels (proxy by INT, EXR, ASP M2) on real sector output (RSO)), as stated in the objective of this study. Following Shin *et al.* (2014), this study substitutes the variables of the study by POS and NEG to arrive at the following NARDL model:

$$\begin{aligned}\mathbf{lnRSO}i, t = {} & \boldsymbol{\theta_0} + \sum_{q=1}^{n} \boldsymbol{\theta_{1q}\Delta lnRSO_{i,t-q}} \\ & + \sum_{q=1}^{n} \boldsymbol{\theta_{2q}\Delta lnINT_{i,t-q}} + \sum_{q=1}^{n} \boldsymbol{\theta_{3q}\Delta lnEXR_{i,t-q}} + \sum_{q=1}^{n} \boldsymbol{\theta_{4q}\Delta lnASP_{i,t-q}} \\ & + \sum_{q=1}^{n} \boldsymbol{\theta_{5q}\Delta lnM2_{i,t-q}} + \sum_{q=1}^{n} \boldsymbol{\theta_{6q}\Delta lnPOS_{i,t-q}} + \sum_{q=1}^{n} \boldsymbol{\theta_{7q}\Delta lnNEG_{i,t-q}} \\ & + \boldsymbol{\Upsilon_1\Delta lnRSO_{i,t-q}} + \boldsymbol{\Upsilon_2\Delta lnINT_{i,t-q}} + \boldsymbol{\Upsilon_3\Delta lnEXR_{i,t-q}} + \boldsymbol{\Upsilon_4\Delta lnASP_{i,t-q}} \\ & + \boldsymbol{\Upsilon_5\Delta lnM2_{i,t-q}} + \boldsymbol{\Upsilon_6 POS_{i,t-q}} + \boldsymbol{\Upsilon_7 NEG_{i,t-q}} + \boldsymbol{\mu t} \ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{10})\end{aligned}$$

From equation (14), the short-term effects are the coefficients of the first-differenced variables, while the long-term effects are obtained by setting the non-first-differenced lagged component of equation (10) to zero and normalizing $\boldsymbol{\Upsilon_2}$ to $\boldsymbol{\Upsilon_7}$on $\boldsymbol{\Upsilon_1}$. Analytically, Shin *et al*. (2014) have demonstrated that Pesaran *et al.* (2001) bounds testing procedure is applicable in this case.

Unit Root Test: Kwiatkowski-Phillips-Schmidt-Shin and Elliott-Rothenberg-Stock Point

Two unit root tests, the Kwiatkowski-Phillips-Schmidt-Shin's (KPSS) and the Elliott-Rothenberg-Stock Point (ERS) were used in this study to examine the stationarity property of the data set and ensure the efficacy of the results. Most previous studies such as Sanusi (2010) and Asgar and Hussain (2014) use augmented dickey-fuller (ADF) and Phillips-Perron (PP) for unit root testing. The choice of KPSS and ERS was not only informed by the imperatives of comparison of results and consistency but also to avoid the problem of high size distortion

associated with ADF and PP unit root test options. Thus, rejection of the null hypothesis occurs if KPSS > CV. The KPSS unit root model is specified as:

$$\Delta X = \gamma_0 + \gamma_1 + \gamma_2 X_{t-1} + \sum_{k=0}^{n} \lambda \Delta x + \mu t \quad \text{.....(11)}$$

Where;

γ_0, γ_1, γ_2, λ = parameters to be estimated

μ_t= the error term.

Post- Estimation Diagnostic Tests

Post-estimation diagnostic tests of serial correlation, heteroscedasticity, normality and stability test were used to access, check and ensure efficacy of the results.

Types and Sources of Data

The study used secondary time-series data for the analysis. The annual data covers the period of 44 years, from 1980 to 2023. The data were obtained from theWorld Bank Development Indicators. The variables on which data were collected are the Real sector output (RSO), interest rate (INT), exchange rate (EXR), broad money supply (M2), and asset price (ASP).

4. Results and Discussion of Findings

Descriptive Statistic

Table 1: Result of Summary Statistic

Variables	RSO	INT	EXR	ASP	M2
Mean	3.380836	17.04690	145.7310	3.075175	2.816024
Median	3.396211	16.89862	114.8990	3.621230	2.671176
Maximum	3.669826	31.65000	1554.080	6.263218	4.656375
Minimum	2.899944	8.431667	0.546781	-0.903752	2.204236
Std. Dev.	0.181193	4.912952	2.470712	2.204012	0.456320
Skewness	0.577594	0.345833	4.378165	0.461417	1.481544
Kurtosis	2.762879	3.488776	2.525859	1.871297	3.847448
Jarque-Bera	2.549588	1.315055	1048.883	3.896918	43.23503
Probability	0.279488	0.518131	0.080000	0.142494	0.041000

Source: Researcher's Computation using e-views 9

Table 1 shows the result of summary statistics for RSO, INT, EXR, ASP and M2. Based on the result, the mean for all the variables is positive and is as small as possible, except INT and EXR. Also, the standard deviations for all the variables are as small as possible, suggesting that the estimated values for RSO, INT, EXR, ASP and M2 are not significantly different from their true values. Furthermore, the result shows that all the variables are positively skewed to the right while their estimated kurtoses fall within the acceptable limit of +3 or -3. Hence, the data do not suffer the problem of leptokurtosis. Again, the probability values of Jarque-Bera for all the variables, except M2, were insignificant at 0.05% level. This suggests that all the variables of the study, except M2, are normally distributed.

Lag-Length Selection Criteria

Table 2: Lag-Length Selection Criteria Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-33.89798	NA	6.78e-06	2.288117	2.512581	2.364665
1	100.8821	221.9907	1.08e-08*	-4.169534*	-2.822745*	-3.710240*
2	146.1789	61.28391	3.64e-09	-5.363464	-2.894351	-4.521425
3	186.4908	42.68319*	1.96e-09	-6.264163	-2.672727	-5.039381
4	223.0327	27.94386	1.87e-09	-6.943103	-2.229342	-5.335575

*The * indicate lag order selected by criterion*
Source: Researcher's Computation using e-views 9

Table 2 above shows the lag length selection criteria. From the table, lag order one was selected for this study as indicated by Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn Information (HQ). Thus, one lag was chosen.

Unit Root Test of Stationarity

Table 3: Result of Unit Root Test of Stationarity

Variables	KPSS Level	KPSS Difference	Remarks (KPSS)	ERS Level	ERS Difference	Remarks (ERS)
RSO	0.113765*****	0.334875	I(0)	9.324447*	2.507787	I(0)
INT	0.169095	0.053356*****	I(1)	17.83983*	2.514020	I(0)
EXR	0.188974	0.145123*****	I(1)	19.35371*	11.62637	I(0)
ASP	0.189849	0.096695*****	I(1)	14.62937*	3.120997	I(0)
M2	0.077382*****	2.507787	I(0)	4.339531	12.06964*	I(1)
KPSS critical value at 5% = 0.146000				ERS critical value at 5% = 5.720000		
H_0 KPSS: Variables are stationary				H_0 ERS: Variables are not stationary		

** denote stationary at 5% level of significant*
Source: Researcher's Computation using e-views 9

Table 3 shows the result of KPSS and ERS unit root tests using Newey-West Bandwidth and spectral estimation. The KPSS results, at 5% indicate that RSO and M2 are stationary at levels. Because their KPSS test statistics at levels are less than their KPSS critical value at levels. This implies that RSO and M2 are integrated of order zero [I (0)] while INT, EXR and ASP are stationary at first difference [I (1)]. For ERS result, however, at 5% indicates that RSO, INT, EXR, ASP are stationary at levels [I (0)]. Because their ERS test statistics are greater than their ERS p-statistic at levels. While M2 is stationary at first difference [I (1)]. Thus, the results of KPSS and ERS tests suggest that the variables are integrated in different orders.

F-Bound Co-integration Test for NARDL

Table 4: Result of Bound Co-integration Test

F-Bounds Test			Null Hypothesis: No levels of relationship	
Test Statistic	Value	Significant.	I(0)	I(1)
F-statistic	15.86200	10%	2.12	3.23
K	6	5%	2.45*	3.61*
		2.5%	2.75	3.99
		1%	3.15	4.43

Source: Researcher's Computation using e-views 9

Table 4 shows the result of F-Bound test conducted to determine the existence of a long-run relationship between monetary transmission channels and real sector output. The result revealed that the F- statistic is 15.86200, however, the value is greater than 5% critical values. Therefore, the null hypothesis of no levels relationship is rejected and concluded that the variables of the study have a long-run equilibrium relationship. This study agrees with the findings of Le *et al.* (2014), Ezeaku *et al*. (2018), Egbulonu (2018) and Thankgod *et al.* (2022).

Long-Run NARDL Model

Table 5:Result of Long-Run NARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT_t (+)	-0.007429	0.050006	-0.148558	0.8830
INT_t (-)	0.034204	0.054005	0.633344	0.0320**
EXR_t (+)	0.004472	0.003588	1.246554	0.0237**
EXR_t (-)	-0.065467	0.073630	-0.889136	0.3821
ASP_t (+)	0.134457	0.586819	0.229129	0.0306**
ASP_t (-)	-0.186019	0.260560	-0.713919	0.4831
$M2_t$ (+)	0.049464	0.211600	0.233762	0.0174**
$M2_t$ (-)	0.019662	0.078885	0.249253	0.8051
Constant	3.239321	1.626563	1.991514	0.0570

Source: Researcher's Computation using e-views 9

Table 5 presents the result of long-run NARDL estimated coefficients. The result reveals that a positive interest rate has a negative and statistically insignificant (0.05%) impact on real sector output in Nigeria. That is, 1% increase in interest rate decreases real sector output by 74%. The negative interest rate has a positive and statistically significant (0.05%) impact on real sector output in Nigeria. That is, 1% decrease in negative interest rate increases real sector output by 34%. This implies that higher interest rates make loans from financial institutions become costlier and savings attractive for businesses and households. This discourages investment and reduction in capital expenditure, leading to lower economic activity. However, lower interest

rates enhance credit flow, especially to the major real sectors. This finding agrees with the findings of Ezeaku *et al.* (2018).

In addition, the result of Table 5 shows that a positive exchange rate has a positive and statistically significant (0.05%) impact on the real sector in the long run. That is, 1% appreciation in the exchange rate increases real sector output by 44%. While a negative exchange rate has a negative and statistically insignificant (0.05%) impact on real sector output in Nigeria. That is, 1% depreciation in the exchange rate decreases real sector output by 65%. By implication, an appreciating exchange rate makes imported raw materials and capital goods cheaper for investors, which enhances production efficiency and profitability. This finding agrees with Egbulonu (2018), Le *et al.* (2019) and Alfa *et al.* (2023).

Moreover, the result in Table 5 shows that positive asset price has a positive and statistically significant (0.05%) impact on real sector output in the long run. That is, 1% increase in asset price increases real sector output by 13%. While negative asset price has a negative and statistically insignificant impact on real sector output. This implies that 1% decrease in asset prices decreases real sector output by 18%. By implication, higher asset prices encourage businesses to invest more in productive areas. This agrees with the findings of Alfa *et al.* (2023) and Ahmed *et al.* (2018).

Furthermore, the table also shows that negative money supply has a positive and statistically significant (0.05%) impact on real sector output in the long run. This implies that 1% increase in positive money supply increases real sector output by 49%. Likewise, a negative money supply has a positive but statistically insignificant impact on real sector output. This implies that 1% decrease in negative money supply increases real sector output by 19%. By implication, growing money supply enables businesses and households to access more funds from financial institutions through loans and investment, driving production and consumption, and leading to growth in real sector output. This advanced the findings of Egbulonu (2018), Le *et al.* (2019) and Muhammad *et al.* (2020).

Short-Run NARDL Model

Table 6: Result of Short-Run NARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔINT_t (+)	-0.009201	0.022209	-0.414281	0.6821
ΔINT_t (-)	0.000112	0.020399	0.005508	0.0356**
ΔEXR_t (+)	-0.000665	0.001202	-0.552998	0.0450**
ΔEXR_t (-)	-0.006160	0.021084	-0.292145	0.7725
ΔASP_t (+)	0.113707	0.223782	0.508115	0.0157**
ΔASP_t (-)	-0.085815	0.235331	-0.364655	0.7190
$\Delta M2_t$ (+)	0.009453	0.017037	0.554812	0.0308**
$\Delta M2_t$ (-)	-0.030157	0.027232	-1.107419	0.2783
ECM_t	-0.309551	0.154817	-1.999460	0.0461**
R-squared	0.785712	F-statistic		6.355486
		Durbin-Watson Stat		1.782446

Source: Researcher's Computation using e-views 9

Table 6 shows the result of short-run NARDL estimated coefficients. The result reveals a negative error correction term (ECMt), as anticipated, negative and statistically significant at 5% level. The negative sign implies that there is an adjustment from short-run to long-run equilibrium among the variables of the study. The coefficient of ECMt indicates the speed of adjustment of about 30% from the short run to the long run.Table 6 also shows that in the short run, a positive interest rate has a negative impact but is statistically insignificant at 5% level. This implies that 1% increase in interest rate, decreases real sector output by 92%. The negative interest rate is positive but statistically significant at 5% level. This indicates that lower interest rate reduces borrowing costs which eventually stimulate investment and encourage economic growth.

Additionally, the result shows that a positive exchange rate has a negative impact but is statistically significant at 5% level in the short run. This implies that 1% increase in exchange rate decreases real sector output by 11%. The negative exchange rate has a negative impact but is statistically insignificant at 5% level. This implies that 1% decrease in exchange rate decreases real sector output by 61%. This also clearly indicates that as naira appreciates, it becomes more valuable relative to other currencies. This leads to a reduction in the cost of imports, lower production costs and boosts output.Moreover, the result shows that positive asset price has a positive but statistically significant impact on real sector output in the short run. This implies that 1% increase in asset price increases real sector output by 11%. While negative asset price has a negative but statistically insignificant impact on real sector output. This implies that 1% decrease in asset price decreases real sector output by 94%. This indicates that higher asset prices encourage businesses to invest more in productivity activities.

Furthermore, the result shows that a positive money supply has a positive but statistically significant impact on real sector output in the short run. This implies that 1% increase in money supply increases real sector output by 94%. While negative money supply has a negative but statistically insignificant impact on real sector output. This implies that 1% decrease in money supply decreases money supply by 30%. This indicates that a higher money supply, lower interest rates and increased availability of credit, consumption and investment, translate into an increase in productivity. This also advances Le *et al.* (2019). The R-squared of the model shows that about 78% of the variation in real sector output is explained by the combined positive and negative effects of all the determinants of real sector output used in this study, suggesting that about 22% of the variation in real sector output is accounted for by the other factors not included in the model. Hence, the model is a good fit. The F-statistic is high, which implies that the parameters are significant. The D-W value is closer to 2, this implies that there is evidence of negative autocorrelation in the data set used for this study.

Wald Test for NARDL

Table 7: Result of Wald Test for NARDL

Test Statistic	Value	Df	Probability
F-statistic	0.392242	(4, 21)	0.0118**
Chi-square	1.568969	4	0.0244**

Source: Researcher's Computation using e-views 9

Table 7 shows the results of the joint asymmetries. The null hypothesis of the test is that the addition of the partial sum of the decomposition of monetary transmission channels into positive (+) and negative (-) changes is not important. Based on the Wald test F-Statistic, the P-values are positive and statistically significant at 5% level. Hence, the null hypothesis is rejected. This indicates that there exists an asymmetric effect of transmission channels on real sector output in Nigeria both in the short run and long run over the period of this study.

Post-Estimation Diagnostic Tests

Table 7: Result of Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.805212	Prob. F(1,27)	0.1903
Obs*R-squared	2.632124	Prob. Chi-Square(1)	0.1047

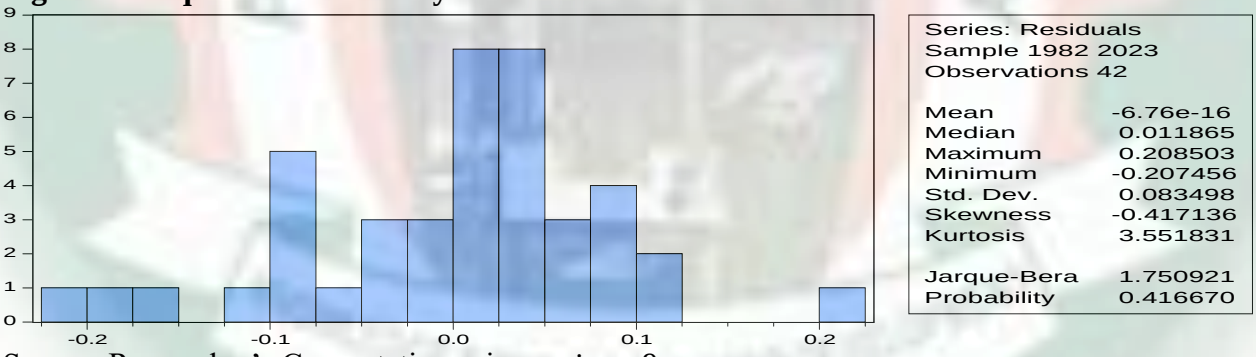
Result of Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.717596	Prob. F(13,28)	0.7314
Obs*R-squared	10.49613	Prob. Chi-Square(13)	0.6529
Scaled explained SS	5.952076	Prob. Chi-Square(13)	0.9479

Source: Researcher's Computation using e-views 9

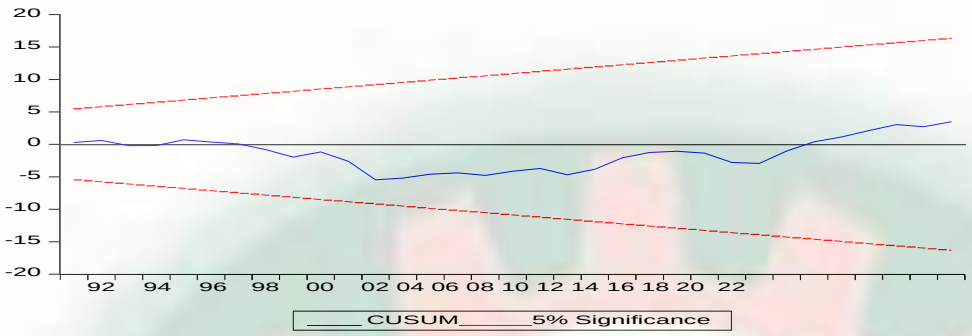
Table 7 shows the post estimations statistical tests for the variables of the study. The serial correlation LM test has a probability value of 0.1903 which is greater than 0.05. This suggests that the null hypothesis of the absence of autocorrelation in the model cannot be rejected. Similarly, the probability value for the test of heteroskedasticity is 0.7314 implying that the null hypothesis of absence of heteroskedasticity in the model cannot be rejected.

Figure 1:Jarque-Bera Normality Test



Source: Researcher's Computation using e-views 9

Figure 2: Stability Test



Source: Researcher's Computation using e-views 9

Figure 1 shows that the Jarque-Bera normality test value and its probability are 1.750921 and 0.416670 respectively. Hence, the null hypothesis that the error terms of the data used in the study are normally distributed cannot be rejected. Furthermore, the result passed the test of stability. This is because the CUSUM plot reported in Figure 2 does not cross either of the 5% critical lines. Therefore, it could be concluded that the estimated parameters for the study are stable and trustworthy for the period under study.

5. Conclusion

The findings revealed that an increase in interest rate has a negative and insignificant impact on real sector output in Nigeria. But decrease in interest rates has a positive and significant impact on real sector output in Nigeria. That is, lower interest rates enhance credit flow, especially to the major real sectors. Appreciation of the exchange rate has a positive and significant impact on the real sector. That is to say that, as the exchange rate appreciates, it makes imported raw materials and capital goods cheaper for investors. However, positive assets price has a positive and significant impact on real sector output. By implication, higher asset prices encourage businesses to invest more in productive areas. Additionally, an increase in money supply has a positive significant impact on real sector output. By implication, a growing money supply enables businesses and households to access more funds from financial institutions through loans and investments. In the short run, findings revealed a negative error correction term, as anticipated, negative and statistically significant. The coefficient of error correction term indicates the speed of adjustment of about 30% from the short run to the long run.

6. Recommendations

Based on the findings, the following recommendations were made:

1. The Central Bank of Nigeria should maintain interest rates that support investment in real sectors of the economy. This can be achieved by lowering lending rates, which would enhance credit flow to key sectors such as industrial, agriculture, manufacturing and services. Increased access to credit in these areas would boost consumption and investment spending, which would ultimately drive productivity and growth in the economy.
2. The Central Bank of Nigeria should adopt a managed exchange rate policy that promotes stability allowing controlled depreciation to boost competitiveness in export-oriented

sectors. This can be achieved by encouraging exports through subsidies and tax breaks. The federal government can also invest in infrastructures that support export-driven industries. This approach will harness the benefits of competitive exchange rates to stimulate real sector growth.

3. The monetary authority in collaboration with the Securities and Exchange Commission (SEC) should deepen financial markets by introducing innovative financial instruments linked to real sector activities like sector-specific investment funds. Additionally, promoting financial literacy, reducing speculative activities and enhancing investor protections will increase market stability and ensure sustained asset price growth that translates into real sector outgrowth.

4. The Central Bank of Nigeria should adopt policies that ensure a steady and controlled expansion of the money supply to support real sector growth. This can be achieved by directing the increased money supply into productive sectors through targeted credit programs, enhancing financial inclusion to improve access to funds, and maintaining inflation at manageable levels to preserve the purchasing power of money.

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