INTERNATIONAL JOURNAL OF FORENSIC ACCOUNTING AND REGULATORY COMPLIANCE

MONETARY POLICY INSTRUMENTS AND THE INDUSTRIAL SECTOR PRODUCTIVITY IN NIGERIA (2008-2022)

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ABSTRACT

The study examined the nexus between monetary policy instruments and the industrial sector productivity in Nigeria. Using time series data from the Central Bank of Nigeria's 2022 statistical bulletin, the research explored how monetary policy variables as liquidity rate, interest rate, money supply and exchange rate affects industrial productivity in Nigeria. Augmented Dickey-Fuller (ADF) unit root text was used to determine the stationary of the variables. The autoregressive distributed lag (ARDL) model was used to take care of financial time series data with different orders of integration. The result indicated that interest rate (INTR) has a significant negative relationship with industrial output, inflation (INFR) has a significant positive relationship, money supply (M2) has a non-significant positive relationship and exchange rate (EXCHR) has a significant positive relationship with industrial productivity (INPDI) in Nigeria. The study recommended among others that there is need to strengthen the regulatory oversight of monetary policy which will ensure transparency, reduce risks, and create a stable environment for industries to access short-term financing for productive activities. Government should implement targeted interventions to support key industries, invest in infrastructure to provide enabling environment for operation, expanding access to money market credits, especially small and medium enterprises (SMEs) as it will provide them with the necessary liquidity to boost their productivity.

Keywords: Industrial productivity, interest rate, inflation, money supply, exchange rate.

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INTRODUCTION

The industrial sector includes companies that involves in the use of factors of productions to produce finished goods and services. Industrialization is essential to national development because there is a strong correlation between value-added industrialization and the level of national wealth (i.e. as measured by GDP per capita), as a result, the importance of the industrial sector in an economy cannot be over emphasized, It serves as a focal point of an economy and instrument of sustainable growth and development because it increases productive capacity and revenue, creates employment opportunities, ensuring effective income distribution, poverty reduction, and contributing to export and gross domestic product (Okoye, Nwakoby & Okorie, 2016) . Anyanwu (2010) asserts that the industrial sector confers many benefits to the nation as it has been adjudged to have the strongest pull on a nation's economic growth and employment generation in many economies. This has spurred successive governments in Nigeria into actions over the years into developing various industrial policies and programs to boost the productivity of the industrial sector. Such industrial policies involve government intervention in embarking on powerful

reforms that will assist in widening the sectorial base of the economy (Aza & Dodo, 2014). Akinwale & Adekunle (2019) assert that these policies are potent instruments for resuscitating and enhancing the effectiveness and efficiency of the industrial sector in the utilization of national resources for stimulating rapid economic growth and development.

The performance of the industrial Sector is a largely dependent on the effectiveness of monetary policies. The Central Bank of Nigeria (CBN) has played the key role of regulating the economy using the money market operations, these are crucial tools used by the CBN to implement monetary policy. They aim at attainment of price stability and sustainable economic growth, with full employment and stable long-term interest and real exchange rates. According to Ojo (2023), monetary policy is relatively easy to alter and apply its policy tools; hence it has become fashionable tool after the introduction of Structural Adjustment Programme (SAP) in 1986 for correcting short term macroeconomic maladjustments in Nigeria. The central Bank of Nigeria (CBN) was established in 1959 with the main objective to regulate the money stock in Nigeria.

The federal government, in collaboration with the CBN has implemented several initiatives to boost the industrial sector in Nigeria. Such initiatives were evident as far back as 1962-1968 during the import substituting industrialization strategy embedded in the first national development plan which focused on domestic production of manufactured goods for domestic market, the Nigeria's indigenization policy was promulgated in 1972, it aimed at increasing the participation of nationals (indigenes) in the commercial and industrial activities in Nigeria, trade and financial liberalization in the 80s, Structural Adjustment Programmes (SAP) of 1986, and the National Economic Empowerment and Development Strategy (NEEDS) launched in 2004, the National Integrated Industrial development instituted in 2007 as a framework developed by the United Nations

Industrial Development Organization (UNIDO) in collaboration with the Federal Ministry of Industry and other stakeholders amongst other policies (Onyeizugbe, Nnadi & Enaini, 2019) . Some specialized institutions were also established to provide assistance to the industrial sector in the form of funding, these includes amongst others the Nigeria Export-Import Bank (NEXIM), the Urban Development Bank (UDB), the Bank of Industry (BOI), and the Bank of Agriculture (BOA) etc. Despite all these measures, it remains doubtful whether the approach of industrial policy-making in Nigeria has indeed been successful in improving productive output in the economy.

Nigeria's industrial sector contributed significantly to the overall output of the economy in the 1980s and 1990s. Its' contribution to GDP averaged 40.97% from 1981 to 1989. The rate declined to 40.07% in the 1990s and further declined to an average of 30.55% from 2000 to 2010. Between 2011 and 2021, the contribution of the industrial sector to GDP averaged 20.03% (CBN Statistical Bulletin, 2021). It is necessary to state that for the industrial sector to thrive in an economy there should be sufficient capital needed for production and growth or expansion and money market is a major market for obtaining short-term funds for industries in Nigeria. However, recent malicious and unethical practices have moved some money market players into exploitative practices that have affected the role of the money market in providing capital for productivity, (Okere, Okonkwo, Francis & Okoye, 2023). Additionally, money market operations help stabilize interest rates, ensuring that borrowing costs remain manageable for industries, thus supporting investment in production capacity and fostering overall economic growth.

Several literatures reviewed showed that a lot had been written on the effect of monetary policy on Nigeria economy as a whole, some literatures focused on the effect of monetary policy on the financial sector; Ehiedu, Onuorah & Akubue (2023), others focused on the manufacturing sector;

Osakwe, Ibenta & Ezeabasili (2019), Hammed (2020), Udoye & Akunna (2024) without much emphasis on the industrial sector. It is important to note the manufacturing sector is only a subsector of the industrial sector, therefore the need to ascertain the effect of these money market instruments used by the CBN to achieve monetary policy objectives on output of the industrial sector as a whole in Nigeria.

LITERATURE REVIEW

Monetary policy and industrial productivity

Monetary policy may be defined as a policy employing the central bank's control of the supply of money as an instrument for achieving the macroeconomic goals. Monetary policy attempts to stabilize aggregate demand in the economy by influencing the availability or price of money, i.e., the rate of interest, in an economy, (CBN,2016) t is regarded as an effective "economic stabilizer" that is frequently applied to determine, regulate, control the quantity of money, cost availability, and influence the direction of money and lending within an economy purposely to achieve some specified macroeconomic policy focus which include increased employment, balance of payment equilibrium and sustainable economic growth and development (orajaka &Akpunonu, 2021). Monetary policy deals with the discretionary control of money supply by monetary authority (CBN) and fiscal authority in an attempt to attain the desired economic goals and this can be expansionary and contractionary. The apex banks carefully consider the timing and coordination of monetary policy decisions to: avoid overheating or overcooling the economy, align with fiscal policy objectives, and respond to global economic trends. Expansionary monetary policy aims to increase aggregate demand and economic growth in the economy; it involves cutting interest rates or increasing the money supply to boost economic activity (CBN, 2016).

Contractionary monetary policy aims to decrease aggregate demand, reduce the general price level and curb inflation which will equally lead to a reduction in the level of investment, employment, output and economic growth (Adegbola, Fadipe & Olajide-Arise, 2015).

The industrial sector is regarded as the engine of economic development, while the financial sector is generally regarded as the lubricant for that engine. (Udeala, 2002) opined that there must be a synergistic relationship between these two sectors, and a sound monetary policy is a prerequisite for this synergy to occur To realize the benefits of capital in the industrialization process, Nigeria needs to put in place a well-articulated and applied macroeconomic policy system, as other industrializing countries have shown (Busari, 2004). He further stated that the mobilization and utilization of savings requires a sound macroeconomic policy. Monetary policy has different transmission mechanisms which impact on industrial productivity in Nigeria, the central bank is the authority charged with manipulating monetary policy through monetary policy instruments in order to achieve desired macroeconomic goals, such as price stability in both domestic and international markets. Monetary policy instruments are instruments of monetary management involving a combination of measures designed by the Central Bank of a country to regulate the availability, value, supply and cost of credit/money in domestic economy with the view to achieving expected macroeconomic stability The interest rates for instance affects borrowing cost and influences investment and production decision, the Central Bank of Nigeria allocates bank credit, fixing interest rates at relatively low levels to promote investment and growth in the industrial sectors, in order to simulate the productive sectors and thus stem inflationary pressures, (Imoisi, Olatunji & Ekpenyong, 2013). These metrics provide proxies for market size and financial structure, such as financial leverage, debt maturity structure, working capital funding needs, and

the cash flow to interest rate payments ratio. Unlike the conventional interest rate channel, financial theories expect that monetary policy would have greater production effects in a recession than in a boom. The explanation for this is because during a recession, when cash flows are poor, businesses are more reliant on external financing, and collateral prices are depressed, the external finance premium, which is based on the borrower's net worth, would be more vulnerable to monetary policy behavior, (Akpunonu, & Orajaka, 2021) Variations in money supply influence liquidity, affecting industrial production likewise inflation. There is excess money supply when the amount of money in circulation is higher than the level of total output of the economy. When money supply exceeds the level, the economy can efficiently absorb, it dislodges the stability of the price system, leading to inflation or higher prices of goods. Money Supply is the life wire of all economic activities and so has powerful effects on the economic life of any nation. An increase in Money Supply puts more money in the hands of producers and consumers and thereby stimulating increased investment and consumption (Akpunonu & Orajaka, 2021). Consumers increase purchases and business firms respond to increased sales by ordering for more raw materials and other resources to achieve more production, the spread of business and capital goods. As the economy goes buoyant, Stock Market prices rise and firms issue more equity and debt instruments. As the Money Supply expands, prices begin to rise, especially if output growth reaches full capacity. Lenders insist on higher interest rates to offset expected decline in purchasing power over the lifespan of their loans. Opposite effects occur when the Money Supply falls or when there is decline in its growth rate, economic activities decline and disinflation (reduced inflation) or deflation (falling price) results (Umeora, 2010).

The exchange rate is said to have a greater impact on the economy than the other monetary intermediate variables because of its impact on the value of domestic currency, domestic inflation, the external sector, macroeconomic legitimacy, capital flows, and financial stability. A rise in the exchange rate has a direct impact on the price of imported goods and services, and an increase in the price of imported goods and services leads directly to inflation (Asiagwu, Utalor, & Anaele, 2021). The study is based on the Keynesian theory of monetary policy. Keynesian View is based on the ideas of John Maynard Keynes, particularly outlined in his work "The General Theory of Employment, Interest, and Money" (1936). Keynes argued that demand, not supplies, and drives the economy. Keynesians see a significant role for monetary policy, especially in the short run. They believe that during periods of economic downturns or recessions, increasing the money supply can reduce interest rates, stimulate investment, and boost aggregate demand. Keynesians believe that economic tools interferes with the economy directly, Keynesians believe that expansionary monetary policy increases the supply of loanable funds available through the banking system, causing interest rates to fall. With lower interest rates, aggregate expenditures on investment, industrialization inclusive and interest-sensitive consumption goods usually increase, causing real GDP to rise. Hence, monetary policy can affect real GDP indirectly (Akpunonu & Orajaka, 2021).

Empirical review

Adishi (2023) examined the impact of monetary policy on industrial sector performance from 1990 to 2020. Using the Auto Regressive Distributed Lag (ARDL) in analyzing the data gotten from CBN Statistical Bulletin, findings showed that; Money supply (BMS) had a positive and significant impact on industrial sector performance in Nigeria; Monetary policy rate (MPR) had a

positive and insignificant impact on industrial sector performance in Nigeria; Liquidity ratio (LQR) had a negative and significant impact on industrial sector performance in Nigeria; and Credit to private sector (CPS) had a negative and significant impact on industrial sector performance in Nigeria.

Okere et al., (2023) evaluated the effect of money market activities on industrial production in Nigeria. Quantitative data (time series data) was sourced from the Central Bank of Nigeria's statistics bulletin in 2021. The findings discovered that the interest rate was a highly predictive and negative factor for industrial sector production in Nigeria, but had little to no influence on production directly. But there exists a strong positive correlation amid the money supply and industrial production in Nigeria. Asiagwu, Utalor, & Anaele (2021) empirically analyzed monetary policy and industrial growth in Nigeria with data spanning from 1996-2019 and found that lending rate (LR), deposit interest rate (DPIR) and money supply growth rate (M2) as proxies for monetary policy have significant impact on industrial growth of developing countries, Nigeria in particular. Akpunonu & Orajaka, (2021) studied the effect of monetary policy on industrial growth in Nigeria between. The results showed that Open Market Operation (OMO) measured by Treasury bill rate had positive and significant effect on the Nigerian Manufacturing Domestic Sector Gross Product; Cash Reserve Ratio (CRR) has a positive and significant effect on the Nigerian Manufacturing Sector Gross Domestic Product; and Monetary Policy Rate (MPR) has a negative and significant effect on the Nigerian Manufacturing Sector Gross Domestic Product

.Hammed (2020) studied the impact of monetary policy shock on the manufacturing output in Nigeria using time series data covering the period between 1981 and 2018. Co-integration test was used to establish the long run relationship among the variables and Structural Vector Auto-

Regressive model was employed to test for the shocks. It was found that shock to broad money supply would bring about a positive and significant impact on the manufacturing output while the impact of shock to interest rate was found to be negative and insignificant. Osakwe, Ibenta & Ezeabasili (2019) examined the effect of monetary policy on the performance of the Manufacturing sector in Nigeria between 1986 to 2017. The data were subjected to Augmented Dicker Fuller stationarity test to determine the best suitable econometric tool of analyses. The Autoregressive Distributed Lag (ARDL) was used for the model estimation. The results indicate that: monetary policy tools have a significant effect on the manufacturing sector output in Nigeria in the short run only. The study thus concludes that monetary policy tools may not be a long run policy instrument for the growth of the manufacturing sector output in Nigeria but rather short run instruments. Shobande (2019) examines the impact of switching from direct to indirect monetary policy on industrial growth in Nigeria, using the annual time series data sourced from the Central Bank of Nigeria's (CBN) statistical bulletin between 1960 and 2015. The study adopts the Autoregressive Distributed Lag (ARDL) bound testing approach developed by Pesaran, Shin & Smith (2001) for estimating the relevant relationships. The result of the long-run estimates shows that domestic credit, interest rate and trade balance have positive impact on industrial output while money supply, inflation and exchange rate have negative impact on industrial growth. The result of the short-run dynamics shows that change in the previous (one and second lagged) periods of indirect monetary policy (interest rate, money supply, domestic credit and exchange rate) and industrial output were negatively related to change in industrial output. Omini, Ogbeba & Okoi (2017) examined the effect of monetary policy shocks on the industrial output of Nigeria from 1970 to 2015. Two sub-sectors of the industrial sector, the manufacturing subsector and the mineral subsector were analyzed using Restricted Vector Error Correction model (VECM) and Granger

Causality test techniques. Their outcome revealed a positive response of the manufacturing subsector to monetary policy innovations. However, the mineral subsector had a favorable response to banking system credit. Moreover, monetary policy granger-caused the manufacturing subsector in Nigeria. Based on these findings, they recommended sectorial considerations in monetary policy decisions of the apex bank.

METHODS

The study made use of secondary data sourced from the CBN statistical bulletin, it adapted and modified the model from the work of Ojo (2023) which examined nexus between monetary policy instruments and the growth of manufacturing sub-sector in Nigeria. Thus, the model is specified as follows: MANGDP = f(M2, INTR, EXCHRT, INFRT) (1) Where; MAN = Manufacturing output, M2 = Broad Money Supply, INTR = Interest Rate, EXCHRT = Exchange Rate, INFRT = Inflation Rate.

The model was adapted and modified to incorporate industrial productivity measured by the Industrial production index (INPDI), expressed as a function of money supply (M2), interest rate (INT), inflation rate (INF) and exchange rate (EXCH). Thus, the model is specified as follows:

INPDI = f(M2, INT, EXCH, INF)---------- (1)

$$INPDI = \beta 0 + \beta 1M2 + \beta 2INTR + \beta 3EXCHRT + \beta 4INFRT + \mu t \text{ ---------- } (2)$$

Where; INPDI = Industrial output measured by industrial production index

M2 = Broad Money Supply,

INT = Interest Rate

EXR = Exchange Rate,

INF = Inflation Rate.

β0 denotes the constant term, β1 β2 and β3 are slope coefficients representing Parameters to be estimated and μ is the disturbance term assumed to be purely random

RESULTS

Table 1: Descriptive statistics results

	INPDI	INTR	INFR	M2	EXCH
Mean	114.5138	16.06375	25.45188	22781.38	232.5869
Median	116.8500	16.75500	25.92500	20650.57	175.9150
Maximum	139.1100	19.33000	30.60000	48462.07	425.9800
Minimum	90.00000	11.48000	18.36000	5127.400	118.5700
Std. Dev.	16.96880	2.266612	3.814534	12549.32	103.5590
Skewness	-0.004822	-0.780975	-0.441513	0.455605	0.590103
Kurtosis	1.786781	2.776272	2.213547	2.240026	1.891873
Jarque-Bera	0.981328	1.659830	0.932162	0.938576	1.747220
Probability	0.612220	0.436086	0.627456	0.625447	0.417442
Sum	1832.220	257.0200	407.2300	364502.0	3721.390
Sum Sq. Dev.	4319.102	77.06297	218.2600	2.36E+09	160866.9
Observations	16	16	16	16	16

Source: Data output via E-views 12 .0

Table 1 displays the descriptive statistics outcomes for the complete study sample. In this comprehensive dataset, we identified that the mean (or standard deviation) values of Index of Industrial Production (INPDI) Interest Rate (INTR), Inflation Rate (INFR), Money Supply(M2) and Exchange Rate (EXCH)are 114.5138, 16.06375, 25.45188, 22781.38and 232.5869(alternatively 16.96880, 2.266612, 3.814534, 12549.32and 103.5590). The range of

values spans from 48462.07to 11.48000for the five variables, with skewness exhibiting both negative and positive values, indicative of a distribution that is both negatively and positively skewed.

The attainment of stationarity by variable(s) is necessary in model estimation due to the influence of non-stationarity on regression output. To this effect, the Augmented Dickey-Fuller (ADF) unit root test was used to prove that the data were stationary. Augmented Dickey-Fuller (ADF) unit root text was used to determine the stationarity of the variables.

Table 2: Result of ADF Unit Root Test at Level

Variables	ADF Test Statistic	Test Critical Value at 1%	Test Critical Value at 5%	Remark
INPDI	-0.567304(0.1286)	-3.959148	-3.081002	Not Stationary
INTR	-1.268420(0.6150)	-3.959148	-3.081002	Not Stationary
INFR	-1.797047(0.3674)	-3.959148	-3.081002	Not Stationary
M2	2.270178(0.9998)	-3.959148	-3.081002	Not Stationary
EXCH	1.263730(0.9968)	-3.959148	-3.081002	Not Stationary

Table 2 shows that none of the variables were stationary at level but stationary at 1st diff and 2nd diff meaning there is mixed integration hence the need to use ARDL as method of data analysis.

Table 3: Result of ADF Unit Root Test at 1ST DIFF

Variables	ADF Test Statistic	Test Critical Value at 1%	Test Critical Value at 5%	Remark
INPDI	-2.596731(0.1166) **	-4.004425	-3.098896	Not Stationary
INTR	-3.775006(0.0151) **	-4.004425	-3.098896	Stationary
INFR	-5.485001(0.0008) **	-4.004425	-3.098896	Stationary
M2	-1.954892(0.3006)	-4.004425	-3.098896	Not Stationary
EXCH	-2.659774(0.1052) **	-4.004425	-3.098896	Not Stationary

Table 3 shows that none of the variables were stationary at level but stationary at 1st diff and 2nd diff meaning there is mixed integration hence the need to use ARDL as method of data analysis.

Table 4: Result of ADF Unit Root Test at 2ndDIFF

Variables	ADF Test Statistic	Test Critical Value at 1%	Test Critical Value at 5%	Remark
INPDI	-3.895191(0.0132)**	-4.057910	-3.119910	Stationary
INTR	-5.648917(0.0007)**	-4.057910	-3.119910	Stationary
INFR	-8.788951(0.0000) **	-4.057910	-3.119910	Stationary
M2	-4.603372(0.0040) **	-4.057910	-3.119910	Stationary
EXCH	-3.658595(0.0199) **	-4.057910	-3.119910	Stationary

Table 4 shows that none of the variables were stationary at level but stationary at 1st diff and 2nd diff meaning there is mixed integration hence the need to use ARDL as method of data analysis.

The Augmented Dickey-Fuller (ADF) unit root text in tables 2, 3, and 4 indicates that none of the variables were stationary at level implying that the variables should be differentiated further. Again, INTR and INFR were not stationary at the first difference, according to Table 3. Table 4 shows that at the second difference, all the variables were stationary. This is due to the fact that their ADF test statistic value is greater than the Mackinnon critical value of 5% in absolute terms. As a result, Auto Regressive Distributed lag models (ARDL) as method of data analysis was required. With the determination of ARDL as method of data analysis especially short run relationship there is need to determine the long run relationship using ARDL Co-Integration Relationship**.**

ARDL Co-integration Relationship

The confirmation of the stationarity of the data through the unit root test of ADF allows for the determination of the co-integration relationship between the dependent and explanatory variables

in the models. The ARDL was chosen as against the traditional Johansen co-integration because it is structured in such a way that it takes into account the different order of integration of financial time series data. **Co-integration test For Long-run Effect**

ARDL Co-Integration Test

The confirmation of data stationarity through the Augmented Dickey-Fuller (ADF) unit root test allows for assessing the co-integration relationship between the dependent and explanatory variables in the models. The autoregressive distributed lag (ARDL) model was chosen over the traditional Johansen co-integration test because ARDL can handle financial time series data with different orders of integration. The ARDL bounds test follows the critical values at the lower and upper bounds for decision-making at the significance levels of 1%, 2.5%, 5%, and 10%. With a computed F-statistic value of 8.457000, which exceeds the critical bounds at 2.5%, 5%, and 10%, this indicates a long-run equilibrium relationship among the variables. This suggests that the selected variables are co-integrated with industrial production of Nigeria.

Table 5: ARDL bounds tests for Cointegration

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Sig	I(0)	I(1)
F-statistic	8.457000	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author's Calculation employing E-Views 12 Software

Given that the computed F-statistic value of 8.457000surpasses the lower and upper critical bounds at the significance levels of 1%, 2.5%, 5%, and 10%, we infer a stable long-run relationship among

the variables. This implies that the selected variables significantly affect Nigeria industrial production over the long term.

Decision Rule: We reject the null hypothesis of no co-integration and accept the alternative hypothesis that there is co-integration. Thus, we conclude that Interest Rate (INTR), Inflation Rate (INFR), Money Supply (M2) and Exchange Rate (EXCH) have a long-term effect on Index of Industrial Production (INPDI) of Nigeria during the study period.

Nature of Long Run Relationship/ARDL Error Correction Model

The ARDL result has proven that Index of Industrial Production (INPDI) Interest Rate (INTR), Inflation Rate (INFR), Money Supply (M2) and Exchange Rate (EXCH)are co-integrated/related in the long run. Consequently, the determination of the nature of the long run relationship becomes necessary as well as the speed of the adjustment to equilibrium.

Table 6: ARDL Co-integrating and Long Run Form for INPDI→INTR +INFR+M2+EXCH

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INPDI(-1) *	-1.707595	0.423067	-4.036228	0.0100
INTR**	-9.350064	1.774856	-5.268068	0.0033
INFR**	10.76764	1.920144	5.607725	0.0025
M2**	-0.000904	0.001232	-0.733654	0.4961
EXCH**	-0.560048	0.203448	-2.752778	0.0402
CointEq(-1)*	-1.707595	0.169506	-10.07393	0.0002
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTR	-2.2568749	0.503996	-5.096770	0.0038
INFR	5.534935	0.633800	8.732934	0.0003
M2	0.001248	0.000254	4.916055	0.0044
EXCH	-0.860626	0.066371	-12.96693	0.0000
C	133.4791	10.01314	13.33040	0.0000

Computer Output Data using E-views 12.0

The ARDL results indicate that Index of Industrial Production (INPDI), Interest Rate (INTR), Inflation Rate (INFR), Money Supply (M2) and Exchange Rate (EXCH) exhibit a long-term co-integrated relationship. Consequently, it is essential to determine the nature of this long-term relationship and the speed at which deviations from equilibrium are corrected. Table 6 reveals that long-run coefficients from the ARDL model indicate that all of the independent variables Interest Rate (INTR), Inflation Rate (INFR), Money Supply (M2) and Exchange Rate (EXCH)are statistically significant in explaining the dependent variable (INPDI) in the long run. The constant term is also statistically significant.

The error correction term has a coefficient of -1.707595 with a t-statistic of -10.07393 and a p-value of 0.0002, which is highly significant. This term indicates that approximately 17.0% of the disequilibrium from the previous period's shock is corrected in the current period, demonstrating the speed of adjustment towards long-run equilibrium.

Diagnostic Test

Table 7 Test for heteroskedasticity and serial correlation LM test

	F-statistics	Probability
Serial Correlation LM Test:	0.042359	0.9591
Heteroskedasticity Test	0.733882	0.6770

Source: Author's Calculation employing E-Views 12 Software

The Serial Correlation LM (Lagrange Multiplier) test checks for the presence of serial correlation in the residuals of the regression model. A significant result would indicate that the residuals are correlated over time, violating the assumption of no serial correlation. The probability (p-value) of 0.9591is much higher than the common significance levels (0.01, 0.05, or 0.10). This indicates

that there is no evidence to reject the null hypothesis of no serial correlation. Therefore, the residuals do not exhibit significant serial correlation, implying that the model does not suffer from this issue.

The Heteroskedasticity test examines whether the variance of the residuals is constant (homoskedasticity) or varies (heteroskedasticity) across observations. Significant heteroskedasticity would indicate that the model's error terms have non-constant variance, which can lead to inefficient estimates and incorrect inferences. The probability (p-value) of 0.6770 is significantly higher than the common significance levels. This suggests that there is no evidence to reject the null hypothesis of homoskedasticity. Therefore, the residuals exhibit constant variance, and the model does not suffer from heteroskedasticity. The tests indicate that the regression model's residuals do not suffer from serial correlation or heteroskedasticity. This implies that the model meets the assumptions of no serial correlation and constant variance, enhancing the reliability of the estimated coefficients and the overall model.

Short Run OLS Relationship

In analyzing Monetary policy instruments and industrial productivity in Nigeria, the OLS regression was applied and the result shown in Tables 8. The outputs were interpreted using the coefficients of the individual variables, Adjusted R-square, f-statistic and Durbin Watson.

Table 9: Results of ARDL

Dependent Variable: INPDI
Method: ARDL
Date: 09/26/24 Time: 09:35
Sample (adjusted): 2008 2022
Included observations: 15 after adjustments

Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): INTR INFR M2 EXCH
Fixed regressors: C
Number of models evalulated: 16
Selected Model: ARDL(1, 1, 1, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INPDI(-1)	-0.707595	0.423067	-1.672537	0.1553
INTR	-2.568749	0.867447	-2.961275	0.0315
INTR(-1)	-6.781315	1.208029	-5.613534	0.0025
INFR	5.534935	1.272586	4.349359	0.0074
INFR(-1)	5.232705	1.468587	3.563088	0.0162
M2	0.001248	0.001168	1.068972	0.3340
M2(-1)	-0.002152	0.001126	-1.910880	0.1143
EXCH	-0.860626	0.138794	-6.200733	0.0016
EXCH(-1)	0.300578	0.109098	2.755131	0.0401
C	227.9283	66.55160	3.424835	0.0187
R-squared	0.986531	Mean dependent var		113.8280
Adjusted R-squared	0.962288	S.D. dependent var		17.33337
S.E. of regression	3.366060	Akaike info criterion		5.500084
Sum squared resid	56.65180	Schwarz criterion		5.972117
Log likelihood	-31.25063	Hannan-Quinn criter.		5.495056
F-statistic	40.69292	Durbin-Watson stat		1.825851
Prob(F-statistic)	0.000379			

*Note: p-values and any subsequent tests do not account for model selection

Source: Author's E-view 12 computations

Text of Probability

The coefficient for INTR is -2.568749, with a t-statistic of -2.961275 and a p-value of 0.0315, indicating a significant negative relationship. The coefficient for INFR is 5.534935, with a t-statistic of 4.349359 and a p-value of 0.0074, showing a significant positive relationship. The coefficient for M2 is 0.001248, with a t-statistic of 1.068972and a p-value of 0.3340, also indicating a non-significant positive relationship. The coefficient for EXCH is -0.860626, with a

t-statistic of -6.200733and a p-value of 0.0016, showing a significant positive relationship. The constant term is 0.0187, with a t-statistic of 3.424835and a p-value of 0.0187, indicating it is statistically significant.

The R-squared value is 0.986531, meaning the model explains about 98% of the variance in INPDI. The adjusted R-squared is 0.962288, which accounts for the number of predictors. The F-statistic is 40.69292, with a Prob (F-statistic)of 0.000379, showing that the model is statistically significant overall. The Durbin-Watson statistic is 1.825851, which is close to 2 and suggests no autocorrelation in the residuals. The high R-squared value indicates that the model effectively explains the variability in INPDI. The diagnostics confirm that the model is statistically significant and free from autocorrelation issues.

DISCUSSION

The analysis began by testing the stationarity of the variables, revealing different integration orders: stationary at first-order integrated at I(1), and second-order integrated at I(2). Subsequently, auto-regressive distributed lag (ARDL) models were employed. The result indicated that interest rate (INTR) has a significant negative relationship with industrial output; this is in line with the findings of Asiagwu, Utalor, & Anaele (2021) and Simon-Oke & Jolaosho (2016) which concluded that proxies for monetary policy have significant impact on industrial growth. Inflation (INFR) has a significant positive relationship; this conforms to the work of Ojo (2023) who also found a positive significant relationship between inflation and industrial output in Nigeria. Money supply (M2) has a non-significant positive relationship which agrees with the works of Okere, Okonkwo, Francis, & Okoye (2023) and Adishi (2023) that there exists a positive correlation amid the money

supply and industrial production in Nigeria (2023). Exchange rate (EXCHR) has a significant positive relationship with industrial productivity (INPDI) in Nigeria which agrees with the works of Akinwale & Adekunle (2019) which asserts that exchange rate has a positive relationship with industrial productivity in Nigeria, this summarizes that monetary policy is an effective means of improving industry growth as well as growth of the economy. Literatures reviewed from developed countries like Ahmad & Rangaraju (2020) in the United States of America, Chaudhry (2012) in Pakistan are also in agreement that monetary policy is a meaningful tool for achieving both inflation and growth objectives, (Mathal, 2019). This underscores the need for robust regulatory frameworks, transparency, adequate liquidity, and efficient infrastructure especially efficient financial system to ensure smooth functioning and fair access for all market participants.

CONCLUSSION

Monetary policy plays a vital role in enhancing industrial productivity by providing industries with access to short-term financing through the money market, which helps manage working capital needs, cash flow fluctuations, and day-to-day operational expenses. By facilitating the efficient allocation of funds through instruments like commercial paper and short-term loans, the money market ensures that businesses can maintain continuous production cycles, purchase raw materials, and meet immediate financial obligations without disruptions.

RECOMMENDATION

Based on these findings, the study proposes the following recommendations:

- There is need to strengthen the regulatory oversight of monetary policy which will ensure transparency, reduce risks, and create a stable environment for industries to access short-term financing for productive activities.
- Expanding access to money market instruments for a broader range of industries, especially small and medium enterprises (SMEs), will provide them with the necessary liquidity to boost their productivity.
- Educating industrial firms about money market instruments and their benefits can help industries better utilize these markets to manage working capital and improve production efficiency.
- Developing and modernizing the financial market's digital infrastructure will streamline money market operations, reduce transaction costs, and enhance timely access to funds for industrial productivity.
- Collaborating with both public and private sectors to create more tailored money market products that cater to specific industrial needs can improve funding availability and stimulate industrial growth.

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