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**MONETARY POLICY TRANSMISSION AND SECTORAL
HETEROGENEITY IN NIGERIA: EVIDENCE FROM A
DISAGGREGATED ARDL ANALYSIS.**

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ABSTRACT

This study investigates monetary policy transmission and heterogeneous effects across the agricultural, manufacturing, and services sectors of the Nigerian economy from 1985 to 2023. Using a disaggregated Autoregressive Distributed Lag (ARDL) framework, the study examines the short-run and long-run effects of broad money supply (M2), monetary policy rate (MPR), liquidity ratio (LR), and inflation. Unit root results reveal a mixture of $I(0)$ and $I(1)$ variables, while the ARDL bounds test confirms long-run relationships among the variables. The findings indicate significant sectoral heterogeneity in monetary policy transmission. Broad money supply positively influences sectoral output, particularly in agriculture and services, whereas the monetary policy rate exerts a negative effect, with the strongest impact observed in the manufacturing sector. Liquidity ratio positively affects agricultural and manufacturing output but has limited influence on services sector performance. The error correction estimates reveal rapid adjustment to long-run equilibrium following short-run shocks. Furthermore, Wald test results show that monetary policy variables jointly exert significant effects on agricultural output ($p = 0.0102$) and manufacturing output ($p = 0.0017$), but not on services output ($p = 0.1011$), confirming differential sectoral responses. The study concludes that monetary policy transmission in Nigeria is sector-specific and recommends a sector-sensitive monetary policy framework to enhance growth, credit allocation, and policy effectiveness.

Keywords: Monetary Policy Transmission, Sectoral Output, Agricultural Sector, Manufacturing Sector, Services Sector, Nigeria.

JEL Classification: E52, E58, O11, O55, Q14, L16.

1. INTRODUCTION

Monetary policy remains a critical instrument for achieving macroeconomic stability, price stability, sustainable economic growth, and financial system resilience. Through policy tools such as the Monetary Policy Rate (MPR), reserve requirements, and liquidity management operations, central banks influence borrowing costs, credit availability, investment decisions, and aggregate demand. In recent years, persistent inflationary pressures, exchange rate volatility, and post-pandemic recovery challenges have increased the importance of effective monetary policy transmission. However, the effectiveness of monetary policy depends not only on policy actions but also on the structure and efficiency of the financial system through which such policies are transmitted (Oyadeyi, 2024; Eklou et al., 2023). In developing economies, where financial markets are relatively shallow and credit constraints remain prevalent, monetary policy outcomes often differ substantially from those observed in advanced economies (Daoui, 2023).

Monetary policy transmission describes the process through which policy actions affect output, investment, employment, and prices in the economy. Existing literature identifies several transmission channels, including the interest rate, credit, bank lending, exchange rate, asset price, and expectations channels. The effectiveness of these channels varies across countries depending on financial development, institutional quality, and macroeconomic conditions (Eklou et al., 2023; Oyadeyi, 2024). More importantly, recent evidence suggests that monetary policy does not affect all sectors of the economy uniformly, underscoring the need to move beyond aggregate analyses and examine sector-specific responses to policy shocks.

Recent theoretical and empirical studies have increasingly emphasized the role of sectoral heterogeneity in monetary policy transmission. Differences in financing structures, capital intensity, credit dependence, financial constraints, and price rigidities often lead to varying sectoral responses to monetary policy shocks. Cross-country evidence reveals substantial heterogeneity in the responses of firms, industries, and sectors to monetary policy actions (IMF, 2023; Thürwächter, 2022; Kreamer, 2022). Similarly, Sabaj (2025) argues that variations in financial constraints and labour mobility significantly influence the magnitude and persistence of monetary policy effects across economic activities. These findings highlight the need for a disaggregated approach to monetary policy analysis.

Nigeria provides a compelling context for examining sectoral heterogeneity in monetary policy transmission. Over the past four decades, the economy has experienced significant structural transformation characterized by the growing dominance of the services sector, fluctuating manufacturing performance, and sustained policy interventions in agriculture. While these sectors collectively contribute to economic growth, employment, and development, they differ considerably in their access to finance and exposure to monetary conditions. Consequently, monetary policy actions that stimulate growth in one sector may generate weaker or even adverse effects in another. Recent statistics indicate that services remain the largest contributor to GDP, agriculture continues to play a critical role in employment generation and food security, while manufacturing remains central to industrialization and economic diversification (NBS, 2024; World Bank, 2024).

Recent monetary developments further justify the need for sectoral analysis. In response to inflationary pressures and exchange rate instability, the Central Bank of Nigeria (CBN) has implemented various policy measures through adjustments in the Monetary Policy Rate, liquidity management operations, and monetary aggregates. Despite these interventions, inflation remains elevated and sectoral performance continues to diverge. Agriculture has recorded modest growth supported by intervention programmes, manufacturing faces persistent challenges associated with high borrowing costs, while the services sector remains the

dominant contributor to output (CBN, 2023; NBS, 2024). These contrasting outcomes raise important questions regarding the effectiveness and sectoral reach of monetary policy transmission in Nigeria.

Although numerous studies have examined the relationship between monetary policy and economic growth in Nigeria, most focus on aggregate output or individual sectors in isolation. Consequently, limited empirical evidence exists on the comparative responses of the agricultural, manufacturing, and services sectors to monetary policy within a unified analytical framework. This gap is particularly important given the strategic role of these sectors in Nigeria's economic diversification and long-term development agenda.

Research Objectives

The study seeks to:

- a) Examine the effect of broad money supply (M2) on agricultural, manufacturing, and services sector output in Nigeria.
- b) Determine the effect of the Monetary Policy Rate (MPR) on agricultural, manufacturing, and services sector output in Nigeria.
- c) Assess the effect of the liquidity ratio (LR) on agricultural, manufacturing, and services sector output in Nigeria.
- d) Assess the differential effects of monetary policy variables on agricultural, manufacturing, and services sector outputs in Nigeria.

Research Questions

Against this backdrop, the study addresses the following research questions:

- a) What is the effect of broad money supply (M2) on agricultural, manufacturing, and services sector output in Nigeria?
- b) What is the effect of the Monetary Policy Rate (MPR) on agricultural, manufacturing, and services sector output in Nigeria?
- c) How does the liquidity ratio (LR) affect agricultural, manufacturing, and services sector output in Nigeria?
- d) To what extent do the effects of monetary policy variables differ across the agricultural, manufacturing, and services sectors in Nigeria?

To address these questions, this study investigates the effects of broad money supply (M2), Monetary Policy Rate (MPR), and liquidity ratio (LR) on agricultural, manufacturing, and services sector output in Nigeria between 1985 and 2023.

2. LITERATURE REVIEW

2.1 Conceptual Literature

Monetary policy refers to the actions taken by a central bank to regulate the supply, availability, and cost of money in order to achieve macroeconomic stability. Through instruments such as interest rates, reserve requirements, and monetary aggregates, monetary authorities influence borrowing costs, credit availability, investment decisions, consumption, and overall economic activity. The effects of monetary policy are transmitted to the real economy through various channels, including the interest rate, credit, bank lending, exchange rate, asset price, and expectations channels. However, the effectiveness of these channels depends on the level of financial development, institutional quality, and prevailing macroeconomic conditions within an economy (Mishkin, 2019; Eklou et al., 2023).

In Nigeria, key monetary policy variables such as the Monetary Policy Rate (MPR), Broad Money Supply (M2), and Liquidity Ratio (LR) serve as important transmission mechanisms through which monetary policy influences economic performance, while inflation reflects prevailing monetary conditions. These variables affect credit availability, liquidity conditions, investment decisions, and aggregate demand, thereby shaping sectoral output. However, empirical evidence suggests that the impact of monetary policy is not uniform across sectors due to differences in financing structures, capital intensity, and sensitivity to credit conditions. This variation in sectoral responses forms the basis of sectoral heterogeneity and underscores the need for a disaggregated analysis of monetary policy transmission in Nigeria (Oyadeyi, 2024; IMF, 2023).

Sectoral Output and Monetary Policy Transmission in Nigeria

Sectoral output refers to the value of goods and services produced within the major sectors of an economy over a given period. In Nigeria, the agricultural, manufacturing, and services sectors constitute the principal components of the real economy and play significant roles in employment generation, income creation, economic diversification, and overall economic growth. Although these sectors collectively contribute to national output, they differ substantially in their structural characteristics, sources of financing, capital requirements, and responsiveness to macroeconomic policies, particularly monetary policy (CBN, 2023; NBS, 2024).

The agricultural sector remains a critical component of the Nigerian economy, serving as the largest employer of labour and a major source of food supply and raw materials for domestic industries. Despite its importance, the sector is characterized by low mechanization, dependence on rainfall, inadequate infrastructure, and limited access to formal credit facilities. Consequently, agricultural output is influenced by monetary policy mainly through the credit channel, although the effectiveness of monetary transmission may be weakened by the prevalence of informal financing arrangements and government intervention programmes (Okaforcha et al., 2024; Oyadeyi, 2024).

The manufacturing sector plays a strategic role in industrialization, value addition, technological advancement, and employment creation. However, the sector faces numerous constraints, including inadequate infrastructure, high energy costs, foreign exchange shortages, and limited access to affordable credit. Because manufacturing activities are highly dependent on external financing and capital investment, the sector is particularly sensitive to changes in interest rates, liquidity conditions, and credit availability. As a result, monetary policy actions are often transmitted more directly to manufacturing output through the interest rate and bank lending channels (Orji, Ogbuabor, & Anthony-Orji, 2022; Thürwächter, 2022).

In contrast, the services sector has emerged as the dominant contributor to Nigeria's Gross Domestic Product, accounting for more than half of total economic output. The sector comprises telecommunications, financial services, transportation, trade, real estate, entertainment, and other professional services. Its increasing integration with financial markets makes it responsive to changes in monetary conditions, particularly through interest rate movements, liquidity adjustments, and financial market developments. However, the diverse nature of service activities implies that responses to monetary policy may vary considerably within the sector itself (Aiyedogbon & Bot, 2023; IMF, 2023).

The structural differences among agriculture, manufacturing, and services suggest that monetary policy does not affect all sectors uniformly. While manufacturing may respond strongly to changes in borrowing costs and credit conditions, agriculture may be influenced more by access to targeted financing and intervention programmes, whereas services may react through financial market and consumption channels. These variations highlight the existence of sectoral heterogeneity in monetary policy transmission and

justify the need for a disaggregated analysis of sectoral output. Understanding these differences is essential for designing monetary policies capable of promoting balanced and inclusive economic growth in Nigeria (Eklou et al., 2023; Oyadeyi, 2024).

2.2 Theoretical Literature Review

Credit Channel Theory of Monetary Policy Transmission

The Credit Channel Theory of Monetary Policy Transmission, advanced by Bernanke and Gertler (1995), argues that monetary policy affects economic activity through its influence on the availability and cost of credit. Through the bank lending and balance sheet channels, changes in monetary policy alter access to finance, thereby affecting investment, production, employment, and output (Bernanke & Gertler, 1995; Mishkin, 2019).

The theory is particularly relevant because sectors differ in their financing structures, credit dependence, and sensitivity to borrowing costs. Consequently, changes in monetary policy variables such as the Monetary Policy Rate (MPR), Broad Money Supply (M2), and Liquidity Ratio (LR) may generate varying responses across the agricultural, manufacturing, and services sectors (Bernanke & Gertler, 1995; Oyadeyi, 2024).

The Credit Channel Theory therefore provides the theoretical foundation for this study. It explains why monetary policy transmission may not be uniform across sectors and supports the argument that differences in credit access and financing conditions can produce heterogeneous sectoral output responses in Nigeria (Eklou et al., 2023; Oyadeyi, 2024).

2.3 Empirical Literature Review

At the international level, Aruoba and Drechsel (2024) examined the long and variable lags of monetary policy using local projections on disaggregated components of the Personal Consumption Expenditures Price Index (PCEPI). The study found that the response of aggregate inflation to monetary policy tightening becomes significantly negative only after several years and revealed substantial heterogeneity across price categories.

In Nigeria, Akinuli et al. (2024) investigated the effects of macroeconomic variables on manufacturing performance between 1985 and 2022 using the ARDL technique. Their findings revealed mixed effects of inflation, interest rate, exchange rate, and trade openness on manufacturing output. Similarly, Mary et al. (2023) employed the Error Correction Mechanism (ECM) to examine the effects of monetary policy instruments on selected macroeconomic variables from 1986 to 2019 and found that monetary policy rate, cash reserve ratio, liquidity ratio, and money supply exhibited negative and insignificant relationships with inflation and employment.

Using the ARDL approach, Adamu, Oladipo, and Umaru (2023) assessed the impact of disaggregated financial development on monetary policy effectiveness in Nigeria and found that financial market development enhances monetary policy transmission, whereas financial institution development exerts weak influence on inflation control. Likewise, Aiyedogbon and Bot (2023) applied the Nonlinear Autoregressive Distributed Lag (NARDL) model and reported that private sector credit positively influences manufacturing output, while the effects of the monetary policy rate remain mixed and statistically insignificant.

Earlier, Austine et al. (2022) employed the ARDL model to investigate the impact of monetary policy on manufacturing sector contribution to GDP between 1985 and 2019. The study found that the monetary policy rate exerts a significant negative effect on manufacturing output, while inflation and treasury bills positively influence manufacturing performance. From a broader sectoral perspective, Ugwuanyi, Ezenekwe, and Chris (2021) utilized the Structural Vector Autoregressive (SVAR) model and found that money supply, private sector credit, exchange rate, and liquidity ratio positively affect sectoral output, whereas interest rate and inflation exert negative effects.

Focusing specifically on agriculture, Ogbuabor et al. (2020) employed a Vector Autoregressive (VAR) framework to examine monetary policy shocks and found that agricultural output responds negatively to monetary tightening, with the interest rate and credit channels serving as the major transmission mechanisms. Similarly, Olamade (2019) applied the ARDL technique and reported that monetary policy significantly influences value-added growth in both manufacturing and services sectors, although the transmission channels differ across sectors.

At the aggregate level, Ufoeze et al. (2018) employed the Ordinary Least Squares (OLS) technique and found that money supply positively and significantly affects economic growth, while exchange rate exerts a significant negative effect. Likewise, Ayodeji and Oluwole (2018), using a multivariate regression framework, reported that interest rate and liquidity ratio negatively affect economic growth, whereas money supply and exchange rate exhibit positive but insignificant effects.

Earlier studies by Nwoko, Ihemeje, and Anumadu (2016) used multiple regression analysis and found that interest rate exerts a significant negative effect on GDP, while money supply remains statistically insignificant. Similarly, Kyari (2015) employed a VAR model and reported that money supply significantly influences real sector performance. Furthermore, Ndekwu and Eddy (2013), using VAR and OLS techniques, identified the credit channel as the most effective mechanism through which monetary policy affects the Nigerian economy, while the interest rate and exchange rate channels were found to be relatively weak.

Overall, the reviewed studies provide substantial evidence that monetary policy influences economic and sectoral performance through different transmission channels. However, most existing studies focus either on aggregate economic growth or individual sectors in isolation. Limited empirical evidence exists on the differential responses of agriculture, manufacturing, and services sectors within a unified framework. This study therefore fills this gap by examining monetary policy transmission and sectoral heterogeneity in Nigeria using a disaggregated ARDL framework covering the period 1985–2023.

3. METHODOLOGY

Theoretical Framework

This study is anchored on the Credit Channel Theory of Monetary Policy Transmission developed by Bernanke and Gertler (1995). The theory posits that monetary policy affects output through changes in credit availability and borrowing costs. Thus, monetary policy actions influence investment and production by altering the volume of credit supplied by financial institutions and the ability of firms and households to access external finance.

The theoretical relationship may be expressed as:

$$Y = f(\text{MP}, \text{CR})$$

where:

(Y) = Sectoral Output, (MP) = Monetary Policy Variables, and (CR) = Credit Availability.

The framework suggests that changes in monetary policy variables such as the Monetary Policy Rate (MPR), Broad Money Supply (M2), and Liquidity Ratio (LR) affect sectoral output through their influence on credit conditions. Since sectors differ in their financing structures and credit dependence, the effects of monetary policy are expected to vary across agriculture, manufacturing, and services sectors.

Research Design

The study employs an ex-post facto research design, which is appropriate for analysing historical macroeconomic data and examining the relationship between monetary policy variables and sectoral output in Nigeria.

To achieve the objectives of this study, a modified version of Mary et al. (2023) model on the effect of monetary policy on selected macroeconomic variables in Nigeria was adopted.

Model Specifications:

The functional relationship among the series can be represented and modified as follows to accommodate the structure of this study:

$$\begin{array}{ll} AGDP = f(MS, MPR, LRR, INF) & \dots \dots \dots 1 \\ MGDGP = f(MS, MPR, LRR, INF) & \dots \dots \dots 2 \\ SGDP = f(MS, MPR, LRR, INF) & \dots \dots \dots 3 \end{array}$$

Where:

AGDP = Agricultural Sector Output (proxied by Agricultural GDP)

MGDP = Manufacturing Sector Output (proxied by Manufacturing GDP)

SGDP = Services Sector Output (proxied by Services GDP)

MS = Broad Money Supply (M2)

MPR = Monetary Policy Rate

LR = Liquidity Ratio, INF = Inflation Rate

Expressing equation (1) in econometric terms, the linear regression model specification takes the following forms:

$$\ln AGDP_t = \alpha_0 + \sum_{i=1}^p \beta_i \ln AGDP_{t-i} + \sum_{i=0}^{q1} \gamma_i MS_{t-i} + \sum_{i=0}^{q2} \delta_i MPR_{t-i} + \sum_{i=0}^{q3} \phi_i LRR_{t-i} + \sum_{i=0}^{q4} \cap_i INF_{t-i} + \mu_t \quad 4$$

$$\ln MGDGP_t = \alpha_0 + \sum_{i=1}^p \beta_i \ln MGDGP_{t-i} + \sum_{i=0}^{q1} \gamma_i MS_{t-i} + \sum_{i=0}^{q2} \delta_i MPR_{t-i} + \sum_{i=0}^{q3} \phi_i LRR_{t-i} + \sum_{i=0}^{q3} \cap_i INF_{t-i} + \mu_t \quad 5$$

$$\ln SGDP_t = \alpha_0 + \sum_{i=1}^p \beta_i \ln SGDP_{t-i} + \sum_{i=0}^{q1} \gamma_i MS_{t-i} + \sum_{i=0}^{q2} \delta_i MPR_{t-i} + \sum_{i=0}^{q3} \phi_i LRR_{t-i} + \sum_{i=0}^{q3} \cap_i INF_{t-i} + \mu_t \quad 6$$

Where;

All variables as previously defined

α_0 = Constant

$\beta_i, \gamma_i, \delta_i, \phi_i$, and $\cap_i$ are the parameters to be estimated

t = time factor

$\ln$ = Log transformation

μ_t = Error term

Estimation Techniques and Procedures

The study first examines the stationarity properties of the variables using the Augmented Dickey-Fuller (ADF) unit root test to determine their order of integration and ensure that none is integrated of order two, $I(2)$, a prerequisite for the ARDL technique. The ARDL Bounds Test is then employed to determine the existence of a long-run relationship among the variables. Where cointegration exists, the ARDL model is estimated to obtain both the short-run and long-run effects of monetary policy variables on sectoral output, while the Error Correction Model (ECM) captures the speed of adjustment from short-run disequilibrium to long-run equilibrium.

Model adequacy is evaluated using diagnostic and stability tests. The Breusch-Godfrey LM test examines serial correlation, the Jarque-Bera test assesses the normality of residuals, and the CUSUM and CUSUMSQ tests evaluate parameter stability. Finally, the Wald test is employed to examine the joint significance of the monetary policy variables (M2, MPR, LR, and INF) in each sectoral model. The null hypothesis that all coefficients are jointly equal to zero is rejected when the probability value of the Wald F-statistic is less than 0.05, indicating that the monetary policy variables collectively have a significant effect on sectoral output.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Results and Analysis

Descriptive Statistics

Table 1: Descriptive Statistics Results

	AGDP	MGDP	SGDP	M2	MPR	LRR	INF
Mean	11541.23	5510.073	24736.42	23.77039	13.75000	49.22667	19.52569
Median	4935.264	1968.557	7857.690	19.41171	13.50000	46.50000	12.20000
Maximum	53273.14	28442.90	100253.5	60.83624	26.00000	104.2024	76.75887
Minimum	34.23709	39.54680	88.87863	-2.010000	6.000000	26.39276	0.223606
Std. Dev.	14432.36	7901.555	30246.45	16.46595	3.777966	14.66656	17.77567
Skewness	1.388811	1.792375	0.998733	0.602788	0.700402	1.490840	1.778331
Kurtosis	4.059187	5.185766	2.639791	2.501925	4.637091	6.635027	5.262882
Jarque-Bera	14.36023	28.64552	6.694385	2.764924	7.543766	35.91874	28.87703
Probability	0.000762	0.000001	0.035183	0.250960	0.023009	0.000000	0.000001
Sum	450108.1	214892.9	964720.2	927.0454	536.2500	1919.840	761.5020
Sum Sq. Dev.	7.92E+09	2.37E+09	3.48E+10	10302.84	542.3750	8174.101	12007.02
Observations	39	39	39	39	39	39	39

Source: Author's compilation (2026).

The descriptive statistics indicate substantial variations in sectoral output and monetary policy variables over the study period. Among the sectors, services recorded the highest average output (24,736.42), followed by agriculture (11,541.23), while manufacturing recorded the lowest average output (5,510.07), reflecting the dominance of the services sector in Nigeria's economy. The monetary policy variables show average values of 23.77 percent for money supply (M2), 13.75 percent for the monetary policy rate (MPR), 49.23 percent for liquidity ratio (LRR), and 19.53 percent for inflation rate (INF). The relatively high standard deviations indicate considerable fluctuations in sectoral output and macroeconomic conditions. Furthermore, the positive skewness values suggest that all variables are right-skewed, while the kurtosis statistics indicate that most series are leptokurtic. The Jarque-Bera results show that only money supply (M2) is normally distributed at the 5 percent significance level.

Correlation Matrix

Table 2: Correlation Matrix Results

Correlation Probability	AGDP	MGDP	SGDP	M2	MPR	LRR	INF
AGDP	1.000000 -----						
MGDP	0.984150 0.0000	1.000000 -----					
SGDP	0.979804 0.0000	0.944684 0.0000	1.000000 -----				
M2	-0.093693 0.5705	-0.059582 0.7186	0.183533 0.2634	1.000000 -----			
MPR	-0.080596 0.6257	-0.008150 0.9607	0.106113 0.5203	0.339794 0.0343	1.000000 -----		
LRR	0.362555 0.0233	0.390397 0.0140	0.358449 0.0250	0.018324 0.9118	0.068206 0.6799	1.000000 -----	
INF	-0.171118 0.2976	-0.122034 0.4593	0.198349 0.2261	0.299968 0.0635	0.381084 0.0167	-0.244178 0.1341	1.000000 -----

Source: Author's compilation (2026).

The correlation results reveal strong positive associations among the sectoral output variables, indicating that agricultural, manufacturing, and services outputs tend to move together over time. Among the monetary policy variables, money supply (M2) and monetary policy rate (MPR) exhibit weak negative correlations with sectoral outputs, suggesting limited direct associations during the study period. In contrast, liquidity ratio (LRR) shows moderate positive and significant correlations with agricultural, manufacturing, and services sector outputs, implying that improved banking sector liquidity may support sectoral growth. Inflation (INF) is negatively correlated with all sectoral outputs, indicating that rising prices adversely affect real sector performance. Overall, the relatively low correlations among the explanatory variables suggest

the absence of serious multicollinearity, supporting the suitability of the variables for subsequent econometric analysis.

Test for Unit Root

The Augmented Dickey-Fuller (ADF) test was employed to examine the stationarity and order of integration of the variables. A variable is considered stationary when the probability value of the ADF statistic is less than 5 percent. Table

Table 3: Summary of Unit Root Test Results (ADF Test)

Variable	ADF t-Statistic @ Level	Prob.	Stationary @ Level?	ADF t-Statistic @ 1st Diff.	Prob.	Stationary @ 1st Diff.?	Order of Integration
AGDP	-2.868280	0.0588	No	-3.961567	0.0041	Yes	I(1)
MGDP	-1.920549	0.3196	No	-3.045255	0.0399	Yes	I(1)
SGDP	-2.756050	0.0745	No	-3.140663	0.0321	Yes	I(1)
MS (M2)	-3.518186	0.0128	Yes	—	—	—	I(0)
MPR	-3.225881	0.0261	Yes	—	—	—	I(0)
LRR	-3.630603	0.0096	Yes	—	—	—	I(0)
INF	-3.305474	0.0218	Yes	—	—	—	I(0)

Source: Author's compilation, 2025.

The ADF unit root results indicate a mixed order of integration among the variables. Agricultural GDP (AGDP), Manufacturing GDP (MGDP), and Services GDP (SGDP) were found to be non-stationary at levels but became stationary after first differencing, indicating that they are integrated of order one, I(1). In contrast, Money Supply (MS), Monetary Policy Rate (MPR), Liquidity Ratio (LRR), and Inflation Rate (INF) were stationary at levels and are therefore integrated of order zero, I(0).

The coexistence of I(0) and I(1) variables justifies the application of the Autoregressive Distributed Lag (ARDL) approach, which is appropriate for models involving variables integrated at different orders, provided none is integrated of order two, I(2). Consequently, the study proceeds with the ARDL bounds testing procedure to examine the existence of long-run relationships among the variables.

Co-integration Test

Bounds test of the autoregressive distributed lags technique

Table 4: ARDL Bounds Test for Co-integration

Model	F-Statistic	k	Significance Level	Critical Value I(0)	Critical Value I(1)	Decision (Co-integration)
AGDP Model	4.555698	4	10%	2.45	3.52	Co-integration exists (F > I(1) bound)
			5%	2.86	4.01	
			2.5%	3.25	4.49	
			1%	3.74	5.06	
MGDP Model	7.861134	4	10%	2.45	3.52	Co-integration exists (F > I(1) bound)
			5%	2.86	4.01	
			2.5%	3.25	4.49	

			1%	3.74	5.06	
SGDP Model	4.279215	4	10%	2.45	3.52	Co-integration exists (F > I(1) bound)
			5%	2.86	4.01	
			2.5%	3.25	4.49	
			1%	3.74	5.06	

Source: Authors' computation using E-views 10 version

The ARDL bounds test results indicate the existence of a long-run relationship among the variables in all three sectoral models. The calculated F-statistics of 4.5557, 7.8611, and 4.2792 for the agricultural (AGDP), manufacturing (MGDP), and services (SGDP) models, respectively, exceed the upper bound critical values at the 5 percent significance level. Consequently, the null hypothesis of no long-run relationship is rejected.

The results imply that monetary policy variables, namely money supply, monetary policy rate, liquidity ratio, and inflation, are jointly related to sectoral output in the long run. This confirms the existence of co-integration among the variables and justifies the estimation of both the long-run coefficients and the associated error correction models. The findings further suggest that although short-run fluctuations may occur, sectoral output and monetary policy variables tend to move together towards a stable long-run equilibrium relationship.

Short-Run and Long-Run ARDL Results

Table 5 Estimation of LAGDP Short Run ARDL and ECM Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.077034	0.034975	2.202560	0.0588
D(LAGDP(-1))	-0.188812	0.186639	-1.011645	0.3413
D(LAGDP(-2))	-0.499972	0.154701	-3.231862	0.0120
D(M2)	0.001344	0.001242	2.082197	0.0107
D(M2(-1))	-0.007367	0.002025	-3.638363	0.0066
D(M2(-2))	-0.003767	0.002086	-1.805696	0.1086
D(MPR)	-0.008731	0.007365	-3.185478	0.0298
D(MPR(-1))	-0.020811	0.008770	-2.372982	0.0450
D(MPR(-2))	-0.032199	0.008842	-3.641489	0.0066
D(MPR(-3))	-0.026727	0.008589	-3.111928	0.0144
D(MPR(-4))	-0.015134	0.007896	-1.916738	0.0916
D(LRR)	-0.000454	0.001552	-0.292188	0.7776
D(LRR(-1))	0.005196	0.001762	2.949225	0.0184
D(LRR(-2))	0.006618	0.001916	3.454374	0.0086
D(LRR(-3))	0.005664	0.002023	2.799583	0.0232
D(LRR(-4))	0.003706	0.001721	2.153896	0.0634
D(INF)	-0.001700	0.002703	3.628812	0.0470
D(INF(-1))	0.006119	0.001866	3.278336	0.0112
D(INF(-2))	0.003989	0.002252	1.771396	0.1144
D(INF(-3))	0.003538	0.001708	2.071789	0.0720
D(INF(-4))	0.004377	0.001715	2.552754	0.0340
CointEq(-1)*	-0.766293	0.004498	-5.845317	0.0000

R-squared	0.875207	Mean dependent var	0.188319
Adjusted R-squared	0.656819	S.D. dependent var	0.159643
S.E. of regression	0.093521	Akaike info criterion	-1.648591
Sum squared resid	0.104955	Schwarz criterion	-0.660946
Log likelihood	50.02605	Hannan-Quinn criter.	-1.311776
F-statistic	4.007580	Durbin-Watson stat	2.051409
Prob(F-statistic)	0.008306		

Source: Author's computation using EViews 10 version

Table 6: Estimation of LAGDP long-run model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	0.172208	0.485156	3.354955	0.0018
MPR	1.538678	3.379992	0.455231	0.6610
LRR	0.149799	0.423522	2.353697	0.0327
INF	-0.030800	0.141061	-2.218345	0.0326

Source: Author's computation using E-views 10 version

Table 7: Estimation of LMGDP Short Run ARDL and ECM Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.066840	0.013044	5.124064	0.0001
D(LMGDP(-1))	0.479582	0.070143	6.837175	0.0000
D(M2)	-0.002450	0.000445	-5.501830	0.0000
D(MPR)	-0.002911	0.002272	-2.281451	0.0183
D(MPR(-1))	0.008670	0.002383	3.637596	0.0022
D(MPR(-2))	0.014067	0.002285	6.155357	0.0000
D(MPR(-3))	0.008102	0.002325	3.483907	0.0031
D(MPR(-4))	0.009023	0.002217	4.070535	0.0009
D(LRR)	0.002822	0.000569	4.962006	0.0001
D(LRR(-1))	-0.003421	0.000639	-5.351959	0.0001
D(LRR(-2))	-0.000780	0.000590	-1.322395	0.2046
D(LRR(-3))	-0.003879	0.000588	-6.594447	0.0000
D(LRR(-4))	-0.004545	0.000580	-7.839643	0.0000
CointEq(-1)*	-0.559532	0.002787	-7.009428	0.0000
R-squared	0.945949	Mean dependent var		0.174207
Adjusted R-squared	0.910816	S.D. dependent var		0.124904
S.E. of regression	0.037301	Akaike info criterion		-3.446695
Sum squared resid	0.027827	Schwarz criterion		-2.818194
Log likelihood	72.59381	Hannan-Quinn criter.		-3.232358
F-statistic	26.92463	Durbin-Watson stat		2.007796
Prob(F-statistic)	0.000000			

Source: Author's computation using E-views 10 version

Table 8: Estimation of LM GDP Long run model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	0.020308	0.047136	2.430837	0.0423
MPR	-0.542938	0.244692	-2.218862	0.0413
LRR	0.284100	0.136128	2.086998	0.0532
INF	0.182035	0.108416	1.679051	0.1126

Source: Author's computation using E-views 10 version

Table 9 Estimation of LSGDP Short Run ARDL and ECM Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.584168	0.114545	5.099899	0.0006
D(LSGDP(-1))	0.287330	0.139453	2.060403	0.0694
D(M2)	0.000693	0.000615	2.126229	0.0392
D(M2(-1))	-0.002226	0.000955	-2.331664	0.0446
D(M2(-2))	-0.001872	0.000987	-1.895729	0.0905
D(M2(-3))	-0.004256	0.000958	-4.442070	0.0016
D(M2(-4))	-0.003695	0.001133	-3.260308	0.0098
D(MPR)	-0.006370	0.003426	-2.859229	0.0259
D(MPR(-1))	-0.004669	0.003712	-1.257745	0.2401
D(MPR(-2))	-0.002861	0.004665	-0.613332	0.5548
D(MPR(-3))	0.008644	0.003008	2.873164	0.0184
D(LRR)	0.002620	0.000737	3.555208	0.0062
D(LRR(-1))	-0.001213	0.000867	-1.399130	0.1953
D(LRR(-2))	-0.002101	0.000830	-2.532331	0.0321
D(LRR(-3))	0.000156	0.000833	0.186985	0.8558
D(LRR(-4))	0.002757	0.000978	2.818727	0.0201
D(INF)	0.001436	0.001023	1.404555	0.1937
D(INF(-1))	0.005096	0.001159	4.397866	0.0017
D(INF(-2))	0.001733	0.001049	1.651834	0.1330
D(INF(-3))	0.002707	0.001110	2.440167	0.0374
CointEq(-1)*	-0.650565	0.010553	-4.791763	0.0000
R-squared	0.930135	Mean dependent var		0.186671
Adjusted R-squared	0.822651	S.D. dependent var		0.110911
S.E. of regression	0.046708	Akaike info criterion		-3.015936
Sum squared resid	0.028361	Schwarz criterion		-2.073184
Log likelihood	72.27091	Hannan-Quinn criter.		-2.694431
F-statistic	8.653674	Durbin-Watson stat		2.020666
Prob(F-statistic)	0.000134			

Source: Author's computation using E-views 10 version

Table 10: Estimation of LSGDP Long run model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	0.038955	0.073299	2.531459	0.0080
MPR	-0.179830	0.173124	-3.038735	0.0060
LRR	0.041486	0.044847	0.925065	0.3791
INF	-0.019855	0.031159	-2.637218	0.0399

Source: Researchers' computation using E-views 10 version

Discussion of ARDL Results

Agricultural Sector (AGDP)

The short-run ARDL results indicate that broad money supply (M2) exerts a positive and significant effect on agricultural output. Specifically, a one-unit increase in M2 increases agricultural output by 0.0013 units ($p = 0.0107$). However, the lagged values of M2 are negative, suggesting that the expansionary effect weakens over time. The Monetary PolicyRate (MPR) negatively affects agricultural output both contemporaneously (-0.0087 , $p = 0.0298$) and across several lag periods, indicating that higher interest rates discourage agricultural production by increasing borrowing costs. The Liquidity Ratio (LRR) has a positive effect at lagged periods, with coefficients ranging from 0.0052 to 0.0066, implying that increased banking sector liquidity enhances credit availability to agriculture. Inflation exhibits mixed effects, although the contemporaneous effect is negative (-0.0017 , $p = 0.0470$). The error correction coefficient (-0.7663 , $p < 0.01$) is negative and significant, indicating that approximately 76.6% of short-run disequilibrium is corrected within one year.

In the long run, M2 (0.1722, $p = 0.0018$) and LRR (0.1498, $p = 0.0327$) positively and significantly influence agricultural output, while inflation (-0.0308 , $p = 0.0326$) exerts a significant negative effect. The coefficient of MPR (1.5387, $p = 0.6610$) is statistically insignificant, suggesting that interest rate policy does not have a lasting impact on agricultural output. The model explains 87.5% of the variation in agricultural output ($R^2 = 0.875$), and the overall model is significant ($F = 4.008$, $p = 0.0083$).

Manufacturing Sector (MGDP)

The short-run results show that M2 negatively affects manufacturing output (-0.00245 , $p < 0.01$), suggesting that short-term monetary expansion may not immediately translate into increased industrial production. The MPR initially exerts a negative effect (-0.0029 , $p = 0.0183$), although some lagged coefficients become positive, indicating delayed responses within the manufacturing sector. The Liquidity Ratio shows mixed effects, with a positive contemporaneous impact (0.0028, $p < 0.01$) but negative lagged effects. These findings suggest that manufacturing output is highly sensitive to changing monetary conditions. The error correction coefficient (-0.5595 , $p < 0.01$) indicates that 55.9% of short-run disequilibrium is corrected each period.

The long-run estimates reveal that M2 (0.0203, $p = 0.0423$) positively affects manufacturing output, while MPR (-0.5429 , $p = 0.0413$) exerts a significant negative effect. This implies that persistent increases in interest rates constrain industrial investment and production. The liquidity ratio also positively affects manufacturing output (0.2841, $p = 0.0532$), whereas inflation is positive but statistically insignificant (0.1820, $p = 0.1126$). The model demonstrates strong explanatory power with $R^2 = 0.946$, indicating that approximately 94.6% of variations in manufacturing output are explained by the included variables. The model is jointly significant ($F = 26.925$, $p < 0.01$).

Services Sector (SGDP)

The short-run results indicate that M2 positively affects services output (0.00069, $p = 0.0392$), although several lagged values become negative, suggesting temporary adjustment effects. The MPR negatively affects services output in the current period (-0.00637, $p = 0.0259$), indicating that higher interest rates reduce activity within the sector. The liquidity ratio exhibits mixed effects, with positive contemporaneous (0.00262, $p = 0.0062$) and negative lagged impacts. Inflation also displays mixed short-run effects. The error correction term (-0.6506, $p < 0.01$) confirms the existence of a long-run equilibrium relationship and indicates that approximately 65.1% of deviations from equilibrium are corrected each period.

In the long run, M2 (0.0390, $p = 0.0080$) positively and significantly influences services sector output, while MPR (-0.1798, $p = 0.0060$) and inflation (-0.0199, $p = 0.0399$) exert significant negative effects. The coefficient of LRR (0.0415, $p = 0.3791$) is positive but statistically insignificant, suggesting a limited role of liquidity conditions in explaining long-run services sector performance. The model explains 93.0% of variations in services output ($R^2 = 0.930$) and is statistically significant ($F = 8.654$, $p < 0.01$).

Table 11: Post-Estimation Diagnostic Tests for ARDL Models

Diagnostic Test	Agriculture Manufacturing Services			Decision
Serial Correlation LM Test (p-value)	0.0823	0.0763	0.1000	No Serial Correlation
Heteroskedasticity Test (p-value)	0.3724	0.7650	0.1718	Homoskedastic
Normality Test (Jarque-Bera p-value)	0.7190	0.9140	0.8265*	Normally Distributed
CUSUM Test	Stable	Stable	Stable	Stable
CUSUMSQ Test	Stable	Stable	Stable	Stable

The diagnostic results indicate that the estimated ARDL models are econometrically sound. The Breusch-Godfrey LM test confirms the absence of serial correlation, while the Breusch-Pagan-Godfrey test suggests that the residuals are homoskedastic. The Jarque-Bera statistics indicate that the residuals are normally distributed. Furthermore, the CUSUM and CUSUMSQ tests show that all models are stable over the sample period, as the plots remain within the 5 percent critical bounds.

Table 12: Optimal lag length Determinations

Lag selection was based on the Akaike Information Criterion (AIC), which selected the optimal lag structure for the ARDL estimation.

Table 12: Summary of optimal lag length determinations

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-600.5277	NA	1073567.	33.75154	34.05944	33.85900
1	-393.5720	321.9310	174.8396	24.97622	27.43948*	25.83596
2	-309.6236	97.93981*	34.71929*	23.03465	27.65324	24.64666*
3	-252.6117	44.34259	61.46975	22.58954*	29.36348	24.95383

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

Table 13: Summary of Wald Test Results

For the first model: $AGDP = f(MS, MPR, LRR, INF)$

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.342290	(7, 28)	0.0102
Chi-square	23.39603	7	0.0015

For the second model: $MGDP = f(MS, MPR, LRR, INF)$

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	4.497287	(7, 29)	0.0017
Chi-square	31.48101	7	0.0001

For the third model: $SGDP = f(MS, MPR, LRR, INF)$

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.034517	(5, 31)	0.1011
Chi-square	10.17258	5	0.0705

The Wald test was employed to examine the joint significance of monetary policy variables in each sectoral model. The results show that the probability values for the agricultural sector ($p = 0.0102$) and manufacturing sector ($p = 0.0017$) are less than the 5 percent significance level. Consequently, the null hypothesis of no joint effect is rejected for both sectors. This indicates that broad money supply, monetary policy rate, liquidity ratio, and inflation jointly exert significant effects on agricultural and manufacturing sector outputs in Nigeria.

In contrast, the probability value for the services sector ($p = 0.1011$) exceeds the 5 percent significance level. Therefore, the null hypothesis cannot be rejected, implying that the monetary policy variables do not jointly exert a statistically significant influence on services sector output during the study period. The findings suggest that monetary policy transmission is more effective in the agricultural and manufacturing sectors than in the services sector, indicating differential sectoral responses to monetary policy actions in Nigeria.

4.2 DISCUSSION OF RESULTS

The descriptive statistics reveal considerable variation in sectoral output and monetary policy variables over the study period. The services sector recorded the highest average output, followed by agriculture, while manufacturing contributed the least. Correlation results show that inflation is negatively associated with sectoral output, whereas liquidity ratio exhibits positive associations. The low correlation among the explanatory variables suggests the absence of serious multicollinearity.

The unit root results indicate a mixture of $I(0)$ and $I(1)$ variables, justifying the use of the ARDL approach. The bounds test confirms the existence of long-run relationships among sectoral output and the monetary policy variables across all models. The ARDL estimates reveal significant sectoral heterogeneity in monetary policy transmission. Money supply positively influences output across the sectors, while the monetary policy rate negatively affects manufacturing and services output. Liquidity ratio promotes agricultural and manufacturing performance, whereas inflation exerts adverse effects on agriculture and services. These findings suggest that monetary policy affects sectors differently due to variations in credit dependence and financing structures. The results support the Credit Channel Theory and are consistent with previous studies such as Ugwuanyi et al. (2021), Ogbuabor et al. (2020), and Aiyedogbon and Bot (2023). Diagnostic and stability tests further confirm the robustness of the estimated models, indicating their suitability for policy analysis and inference.

The Wald test results indicate that monetary policy variables jointly and significantly influence agricultural output ($p = 0.0102$) and manufacturing output ($p = 0.0017$), but do not significantly affect services sector output ($p = 0.1011$). This suggests that the transmission of monetary policy varies across sectors, providing evidence of sectoral heterogeneity in Nigeria. The significant effect observed in the agricultural sector reflects its dependence on credit availability and financial support programmes. This finding supports the Credit Channel Theory and is consistent with Ogbuabor et al. (2020) and Ugwuanyi et al. (2021), who found that monetary policy significantly influences agricultural and sectoral performance through credit and liquidity channels. Similarly, the significant effect in the manufacturing sector suggests that industrial activities are highly sensitive to monetary conditions, particularly interest rates and credit availability, corroborating the findings of Aiyedogbon and Bot (2023) and Austine et al. (2022).

In contrast, the insignificant result for the services sector implies that its performance is driven more by structural and non-monetary factors than by monetary policy variables. Overall, the findings reinforce the ARDL results and suggest that monetary policy transmission is stronger in agriculture and manufacturing than in services, highlighting the need for a sector-sensitive monetary policy framework in Nigeria.

5. CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

This study examined the transmission of monetary policy to the Nigerian real economy using a disaggregated ARDL framework covering the agricultural, manufacturing, and services sectors over the period 1985–2023. The findings reveal that monetary policy exerts significant but heterogeneous effects across sectors. Broad money supply consistently promotes sectoral output, while the monetary policy rate generally exerts a negative effect, particularly on manufacturing and services sector performance. Liquidity ratio positively influences agricultural and manufacturing output but exhibits limited impact on the services sector. These results indicate that the responsiveness of sectors to monetary policy depends on their financing structures, credit dependence, and operational characteristics.

The Wald test results further reinforce these findings by showing that monetary policy variables jointly exert significant effects on agricultural output ($p = 0.0102$) and manufacturing output ($p = 0.0017$), but not on services sector output ($p = 0.1011$). This suggests that monetary policy transmission is stronger in the agricultural and manufacturing sectors than in the services sector, providing additional evidence of sectoral heterogeneity in Nigeria.

The study therefore concludes that monetary policy transmission in Nigeria is sector-specific rather than uniform. Consequently, a one-size-fits-all monetary policy framework may not effectively achieve balanced growth across the economy. The findings provide support for the Credit Channel Theory of Monetary Policy Transmission, which emphasizes the role of credit availability and borrowing costs in influencing real economic activities.

5.2 Recommendations

Based on the findings, the study recommends that the Central Bank of Nigeria adopt Recommendations

- a) **Enhance Money Supply to Productive Sectors:** The Central Bank of Nigeria should sustain policies that improve credit availability to productive sectors, particularly agriculture and manufacturing, where money supply exerts significant positive effects.
- b) **Adopt a Cautious Interest Rate Policy:** Given the adverse effect of MPR on manufacturing and services output, monetary tightening should be carefully balanced with growth objectives to avoid constraining productive investments.
- c) **Strengthen Sector-Specific Credit Programmes:** Liquidity-enhancing policies and targeted intervention funds should be expanded for agriculture and manufacturing sectors to improve output and employment generation.
- d) **Implement Sector-Sensitive Monetary Policy:** Since monetary policy transmission differs across sectors, policymakers should complement general monetary measures with sector-specific instruments tailored to the unique financing needs of agriculture, manufacturing, and services sectors.

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