



Impact of interest rate liberalization on the real sector output in Nigeria: A Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model

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Received 11 Dec 2024; Accepted 10 Jan 2025; Published 29 Jan 2025

Abstract

This study examined the impact of interest rate liberalization on the real sector output in Nigeria from 1987 to 2024. The specific objectives of this study include: (i) to investigate the impact of real interest rate liberalization on the manufacturing sector output in Nigeria, and (ii) to assess the effects of real interest rate liberalization on agricultural sector output in Nigeria. The method of data analysis was the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The empirical results showed that real interest rate liberalization has a negative and statistically insignificant impact on the manufacturing sector in Nigeria (Z-statistics (-0.332902), Prob-value 0.7392 > Sig-value 0.05) and similarly has a negative and non-significant effect on the agricultural sector in Nigeria (Z-statistics (-1.2220), Prob-value of 0.2217 > Sig-value 0.05). The study recommended that the Nigerian government, through the central bank, should consolidate the gains of financial sector liberalization by implementing policies that enhance credit access for the private sector in order to stimulate output growth. Furthermore, banks should be incentivized to lower lending rates and borrowing costs to encourage domestic investment.

Keywords: Interest liberalization, Real sector output, Manufacturing sector output and Agricultural sector output

1.1 Background of the study

The real sector plays a crucial role in the economy, as it fosters long-term economic growth and creates employment opportunities. Many nations depend on this sector to manufacture goods and services that are competitive in international markets. The real sector refers to the segment of the economy responsible for the production of physical goods and services. It is termed the "real" sector since its outputs are capable of being physically handled, utilized, and sold. This sector encompasses areas such as agriculture, manufacturing, construction, and mining (Okoye, Nwakoby and Modebe, 2018) ^[16].

In contrast to the financial sector, which is concerned with the creation, trading, and management of financial instruments like stocks, bonds, and currencies, the real sector plays a crucial role in the economy. A strong real sector can lead to increased productivity, higher living standards, and improved quality of life for the country. Additionally, a healthy real sector can play a significant role in reducing poverty and income inequality by generating well-paying jobs and providing families and communities with a stable income.

The real sector of the Nigerian economy encompasses sectors such as manufacturing and agriculture. Manufacturing involves the process of producing goods for consumption or sale through the application of labour, machinery, tools, chemicals, and biological methods or formulations. This process is characterized by the large-scale transformation of raw materials into finished products. In a similar manner, industrialization is viewed as a vital means of achieving enhanced quality of life for the population. This is largely attributed to the fact that industrial growth involves a

comprehensive technology-driven advancement of the productive systems within the economy (Nwokoro, 2017) ^[12].

The agricultural sector is crucial for economic growth and development among nations worldwide. Consequently, many countries prioritize the advancement and utilization of this sector to ensure food security as well as generate revenue for developmental purposes. According to a World Bank study conducted in 2016, approximately 65% of impoverished working adults depend on agriculture for their livelihoods. This sector contributes to one-third of the global gross domestic product (GDP) and employs over 1.3 billion individuals, representing nearly 40% of the global workforce (World Bank Group, 2017). Osadime (2018) ^[20] emphasized that agriculture is the primary source of income and employment for 70% of the world's impoverished population residing in rural areas, contributing 10% to the GDP of low and middle-income nations. In Africa, the agricultural sector accounted for 12.7% of GDP and provided jobs for more than 60% of the labor force (African Fact Sheet, 2016).

The term interest rate refers to the cost associated with borrowing money, usually represented as a percentage of the total borrowed amount. It also indicates the returns obtained from savings in financial institutions or from assets like government bonds. The Central Bank of Nigeria (CBN) holds the crucial role of overseeing the regulation of interest rate spreads in the economy. The interest rate spread, also known as interest rate intermediation, refers to the disparity between the rates at which banks lend money and the rates they offer for deposits. The CBN employs the monetary policy rate (MPR) as a tool to manage interest rates, striking a balance that encourages savings and accommodates inflation, while simultaneously keeping rates low enough to facilitate

borrowing for investment. The MPR, which is the rate at which the central bank lends to commercial banks, is particularly significant as it tends to influence all other interest rates in the economy. In their study, Adigun, Ologunwa and Ayilara (2022) ^[2] emphasized that the interest rate is a key factor in promoting the sustainability of real sectors in countries of the world

Interest rate liberalization indicates that market forces, rather than regulatory bodies, determine interest rates (Obagunwa & Akinwale, 2018) ^[13]. This framework enables financial institutions to set their interest rates autonomously through competitive practices. Monetary authorities can only influence interest rates indirectly via macroprudential policies. The goal of liberalization is to eliminate the structural obstacles present in the financial system (Musyoka, 2021) ^[11].

High interest rates currently observed in Nigeria can be attributed to the country's ongoing high double-digit inflation, along with other macroeconomic factors such as the fluctuating naira, increasing spending by subnational governments, and excessive government expenditures. While banks may offer loans to investors at rates reaching 24 percent, the highest return investors can expect on their deposits is around 7.5 percent. This disparity in rates suggests that high lending rates are harmful to economic growth, as they discourage investment (Ogar, Eja & Gbenga, 2021) ^[14]. In light of this context, the present study investigates the effects of interest rate liberalization on the output of the real sector in Nigeria.

1.2 Statement of the problem

The interplay between interest rates and productivity remains an unresolved topic in economic discourse. Interest rates are the returns that borrowers obtain from lenders for the use of capital over a designated time frame. As a cost of capital, interest rates significantly impact the demand for and supply of credit, also known as loanable funds. Changes in interest rates can influence investment activities related to expansion, as well as the purchase of machinery and equipment. Additionally, interest rates facilitate the movement of funds from surplus units (savers) to deficit units (investors) within the economy, ensuring that these resources are utilized effectively to promote the real sector output and growth.

The performance of the real sector in Nigeria is greatly affected by access to credit, which is largely shaped by the prevailing interest rates. Studies have shown that bank credit and lending rates play a significant role in driving economic growth, especially in sectors such as manufacturing and agriculture. However, investors, including businesses and small and medium-sized enterprises, often face considerable hurdles in acquiring affordable credit, with interest rates being a significant contributor to this issue. When interest rates are high, access to credit becomes limited, which adversely impacts the real sector by hindering investment, slowing output growth, and reducing capacity utilization. Adigun, Ologunwa and Ayilara (2022) ^[2] highlighted that the role of the real sector productivity in relation to economic growth and development of any nation cannot be overemphasized. And one essential

element in attaining this macroeconomic objective of a productive real sector is the interest rate.

The Nigerian government implemented interest rate liberalization in 1987 as part of its Structural Adjustment Program (SAP), with the goal of enhancing financial market operations and promoting economic development. This initiative aimed to enable banks to set loan rates based on market conditions, thereby facilitating more effective resource distribution. Interest rate liberalization refers to the removal of restrictions on interest rates, allowing both savings and lending rates to be influenced by supply and demand dynamics. According to Obamuyi (2009), the primary aim of interest rate deregulation is to foster efficiency within the financial sector, promote financial deepening, and improve the allocation of funds for investment and sustainable growth (Oluwole and Ushie, 2022) ^[17].

A detailed analysis of the real sector output in Nigeria over time indicates that its contribution to the gross domestic product (GDP) has been lackluster. This can be linked to the challenges of accessing credit, which are exacerbated by high interest rates. Uzoma, Odungweru and Nwanyanwu (2022) ^[22] emphasized that interest rates are fundamental in the interaction between the financial sector and the real sector. According to a study conducted by the CBN (2018), the real sector contributed above 20 percent to the Nigeria's GDP in 1994, but have been on the decline since then. By 2002, the real sector contributed less than 10 percent to GDP and reduced to 9 percent between 2013 and 2015. The highest growth rate of the Nigerian real sector of 60.3 percent growth rate was recorded in 1994. In 2017 the real sector contributed 9.18 percent, 13.25 percent points higher than growth recorded in the corresponding period of 2016, the real sector contributions to the nation's gross domestic product (GDP) during the period did not change from 2017 share (8.86 percent), as well as in annual contribution, which rose only slightly from 9.18 percent in 2017 to 9.20 percent in 2018. (CBN, 2019).

Previous governmental initiatives aimed at enhancing productivity in the real sector through the deregulation of interest rates by the monetary authority have not produced the expected outcomes. From 2005 to 2020, lending rates exhibited considerable variability, with figures such as 17.95%, 17.26%, 16.94%, 15.14%, 18.99%, 17.59%, 16.02%, 16.79%, 16.72%, 16.55%, 16.85%, 12.32%, 15.53%, 19.33%, 17.56%, and 16.87%. In contrast, the corresponding savings rates were noted at 3.83%, 3.14%, 3.55%, 2.85%, 2.68%, 2.21%, 1.41%, 1.70%, 2.17%, 3.57%, 3.75%, 4.13%, 4.07%, 3.95%, and 3.22%. The absence of significant advancement has compelled the monetary authority to persist in its role of regulating interest rates (CBN, 2020).

Despite significant governmental interventions designed to enhance the output of the real sector in Nigeria, its contribution to the gross domestic product (GDP) has not been particularly impressive. Consequently, this research aims to reassess how interest rate liberalization affects the output of the real sector in Nigeria, with a specific focus on the agriculture and manufacturing sectors.

1.3 Research objectives

The broad objective of this study is to examine the impact of interest rate liberalization on the real sector output in Nigeria within the period of 1987 to 2024. The specific objectives of this study include, to:

- Investigate the impact of real interest rate liberalization on the manufacturing sector output in Nigeria.
- Assess the impact of real interest rate liberalization on agricultural sector output in Nigeria.

1.4 Research questions

The research questions of this study are posed in line with the statement of the research problem:

- What is the impact of interest rate liberalization on the manufacturing sector output in Nigeria?
- What is the effect of real interest rate liberalization on agricultural sector output in Nigeria?

1.5 Significance of the study

This study would be beneficial and relevant to government, monetary policy-makers, general public, researchers and Students.

Government: The results of this research will be crucial for both the government and industry executives in this sector, offering guidance on how to modify interest rates using different policy approaches and to restructure business models that take into account existing interest rates, thereby fostering an enhancement in sector productivity.

Monetary policy makers: The findings of this study will be invaluable to government officials at various levels and monetary policy makers aiming to enhance the performance of the real sector within the Nigerian economy. Moreover, by highlighting specific issues related to the connection between interest rate liberalization and the output of the real sector in Nigeria, this research establishes a foundation for further detailed investigation in this area.

Researchers/students: The findings of this research will benefit students by providing empirical evidence that can enrich the current body of knowledge in the field. As a result, it will serve as a supplementary reference for students.

2.1 Conceptual literature review

2.1.1 Interest rate liberalization

Interest rate liberalization, also known as interest rate deregulation, refers to a policy that abolishes government-imposed controls and regulations on interest rates, enabling them to be set by the market forces of supply and demand (Impalure, Shuaib & Forongn, 2019) ^[8]. This policy aims to achieve a more effective allocation of capital, stimulate investment, and promote financial deepening by allowing market dynamics to dictate borrowing and lending costs. In essence, the deregulation of interest rates grants banks the authority to establish their lending and deposit rates in accordance with market conditions through negotiations with

their customers (Uzoma, et. al, 2022) ^[22]. The anticipated outcomes of interest rate liberalization include enhanced competitive efficiency in financial markets, as interest rates begin to reflect market conditions, allowing resources to be allocated to the most promising (risk-adjusted) investment opportunities, thereby improving allocative efficiency. Furthermore, increased competition can lead to a decrease in financial intermediation costs, resulting in greater operational efficiency. Additionally, liberalization promotes a wider range of financial products, including savings and investment options that can adapt to evolving consumer demands, thus encouraging dynamic efficiency (Aigbogun, 2018) ^[4].

2.1.2 Real Sectors of the economy under study

Agriculture sector output

Agriculture refers to the systematic cultivation and harvesting of plants and animals to produce food, feed, fiber, and various other products. It encompasses the scientific principles involved in utilizing land for the growth of crops and livestock. Essentially, agriculture simplifies natural food webs and redirects energy for human cultivation and animal consumption (Udoka & Anyingang, 2019) ^[21]. Prior to the onset of oil extraction in the 1980s, Nigeria's economy was predominantly reliant on agricultural activities.

The concept of agriculture is very broad such that different individuals, scholars and organizations defined it in different ways with emphasis on crop production as well as animal production. Forestry and fishing and aquaculture are embedded in crop and animal production respectively. Omole and Falokun, (2019) ^[18] defined agriculture as the systematic way of raising useful plants and livestock under the management and control of man. A similar view was presented by Okoye, Nwakoby and Modebe (2018) ^[16] who defined agriculture as a deliberate effort to modify a portion of earth's surface through the cultivation of crops and the raising of livestock for sustenance or economic gains. This definition saw agriculture as a means of livelihood as it laid emphasis on the sustenance of man and economic gains.

Manufacturing sector output

Manufacturing is the process of creating or producing items with the use of resources such as machinery, manpower, tools, chemicals, biological methods and formulations. It is the core of the economy's secondary sector. The phrase may be used to describe a variety of human endeavours, from handcraft to high-tech, but it is most frequently used to describe industrial design, which entails the massive transformation of raw materials from the primary sector into completed commodities. Such items may be delivered through the tertiary sector to end users and customers, sold to other manufacturers for the creation of more sophisticated products (such as aircraft, home appliances, furniture, sports equipment, or vehicles), primarily for consumption or resale (Attah & Ezie, 2018) ^[5].

The manufacturing sector is crucial to the growth of the economy. Because of its tremendous potential for enhanced productivity, more technological advancement, increased capital accumulation, and economies of scale, the industry is

seen as a growth engine. Due to technological innovation, the sector also has the ability to generate employment and manufacture a wide range of high-quality products. It provides income for individuals and tax revenue for the government. Additionally, it aids in closing trade deficits. Furthermore, countries with strong manufacturing industries are more resilient to global economic disruptions due to their varied export markets (Attah & Ezie, 2018) ^[5].

2.2 Theoretical literature

The theoretical literature reviewed in this study is organized into three distinct categories: interest rate theories, economic growth theories, and the connection between interest rates and real sector output.

2.2.1 Loanable funds theory of interest rate

The loanable funds doctrine was formulated in the 1930s by British economist Dennis Robertson and Swedish economist Bertil Ohlin. However, Ohlin attributed its origin to Swedish economist Knut Wicksell and the Stockholm school, which included economists Erik Lindahl and Gunnar Myrdal. According to this theory, the rate of interest is determined by the demand for and supply of loanable funds. The term 'Loanable Funds' means funds or the amount of money which will be lent for interest. The neoclassical or the loanable funds theory explains the determination of interest in terms of demand and supply of loanable funds or credit. According to this theory, the rate of interest is the price of credit which is determined by the demand and supply of credit, or saving plus the net increase in the amount of money in a period, to the demand for credit, or investment plus net savings in the period. Let us analyze the force behind the demand and supply of loanable funds.

Demand for loanable funds: There are three principal sources of demand for loanable funds: the government, business owners, and consumers, who require these funds for investment, saving, and consumption activities. Governments obtain loans to fund the construction of public infrastructure or to prepare for military actions. Business owners, on the other hand, borrow to invest in capital goods and launch new projects. This borrowing behavior is responsive to interest rates and largely hinges on the expected profit margins in relation to the prevailing interest rates. Similarly, the demand for loans for personal purchases, such as scooters and homes, is also influenced by interest rates. Borrowing tends to increase when interest rates are lower, enabling individuals to satisfy their consumption needs more quickly. This demand for financial resources is mainly fulfilled through accumulated savings or through dis-savings.

Supply of loanable funds: The supply of loanable funds originates from the dishoarding of savings and the extension of bank credit. The principal sources of savings are private individuals and corporate entities. While personal savings are affected by income levels, they are considered to be interest elastic when income is treated as a constant. Higher interest

rates tend to increase the inducement to save, and vice versa. Corporate savings, which are essentially undistributed profits, are also influenced by current interest rates to a degree. A high interest rate can discourage borrowing, thereby promoting an increase in savings.

2.2.2 The mundell–fleming interest rate theory

The Mundell-Fleming model integrates international trade and finance into macroeconomic theory. This approach was developed in the early 1960s by the Canadian economist Robert Mundell (winner of the 1999 Nobel Prize in economics) and the British economist J. Marcus Fleming (1911–1976). In this period, both authors were members of the International Monetary Fund's Research Department, where they independently extended the traditional Keynesian model to an open economy setup in which the capital and goods markets are internationally integrated. The resulting research constitutes the original version of the Mundell-Fleming model (Mundell 1963; Fleming 1962).

Mundell-Fleming model of growth will be adopted to explain how interest rates and credit to private sector determine investment in the economy. The Mundell-Fleming model modifies the Keynesian model of an open economy:

$$Y = C + I + G + (X-M) \dots\dots\dots(1)$$

$$Y = C(Y-T) + I(r) + G + NX(e) \dots\dots\dots(2)$$

This equation states that aggregate income Y is the sum of consumption from disposable income, investment which is a function of interest rate and the relationship is negatively sloped, Government expenditure and Net exports which also depends negatively on exchange rate due to capital account liberalization. In the model, price level and money supply are assumed to be fixed.

Under a fluctuating exchange rate system, a small open economy with perfect capital mobility, expansionary fiscal policies will crowd out net exports causing exchange rate to rise. Unlike what happened in a closed economy, fiscal policy will crowd out investment causing interest rates to rise. During a fixed exchange rate policy, the Central Bank has to raise money supply which will be ineffective in inducing investment; therefore it has to combine it with fiscal policies so that investment will thrive (Bartholomew, 2003). This model is useful because it establishes a relationship with the outside world and it explains investment decisions are not done independently of the outside world because of the inflow and outflow of capital (liberalization of capital account).

2.3 Empirical literature review

Berko, Hammond and Amissah (2022) ^[6] investigated the effect of interest rate spread on economic growth in Ghana using annual time series data from 1975 to 2018. Specifically, the study sought to evaluate interest rate spread (IRS), capital stock (K), labour force cost (LAF), government expenditure (GEXP), export value (EXPT) on economic growth. The study used the Engel-granger two-step procedure which uses the OLS

technique to establish both the long-run and short-run relationships between interest rate spread and economic growth. The study established that interest rate spread is a statistically important determinant of economic growth in the short-run, but has a negative impact in the long-run. Also, the result showed that labour force, capital stock, and exports affect economic growth in Ghana positively both in the long-run and short-run. However, government expenditure appeared not to be a statistically significant factor in determining economic growth in Ghana. The study recommended that policy actions that ensure macroeconomic stability should be embarked upon to achieve stability and sustainable growth of the economy. Furthermore, export promotion, investment opportunities as well as producing active labour force should be given a priority.

Omonode (2022) ^[19] investigated the effect of interest rate and money supply on the manufacturing sector output in Nigeria using time series data from 1991 to 2020. Specifically, the study ascertained the effect of interest rate, credit to manufacturing sector, credit to private sector and money supply on manufacturing sector output. The study adopted ex post facto research design. The data used in the study were sourced from the Central Bank of Nigeria Statistical Bulletin 2020. Descriptive statistics and error correction model were employed in analyzing the data. The result of the estimation technique showed that money supply and credit to manufacturing sector had significant positive effect on manufacturing sector output while credit to private sector and interest rate had non-significant effect on manufacturing sector output in Nigeria. Based on the significant f-statistics value, the study concluded that financial intermediation has significant positive effect on manufacturing sector output in Nigeria. The study recommended that there is a need to promote further physical growth of the financial sector. In addition, appropriate incentives should be introduced to encourage financial intermediaries to extend loans to the real sector, as this will help to boost the productivity of the real sector thereby enhancing the general productivity of the economy.

Abdullahi (2022) ^[1] conducted a study to examine the effect of lending interest rate on the growth of manufacturing sector in Nigeria between 1986 and 2015. Specifically, the study sought to investigate the effect of electricity on manufacturing sector, credit to core private sector, lending interest rate, consumer price index, monetary policy rate on annual growth of manufacturing sector. The method of data analysis was the Autoregressive Distributive Lag (ARDL) Model. The empirical results showed that lending interest rate has negative relationship with the growth of manufacturing sector in Nigeria, both in the short run and long run; statistically non-significant in the short run, but statistically significant in the long run. This result was so because lending interest rate in Nigeria has been one of the major factors that determined the output, profit and sustainability of the manufacturing sector. At higher lending interest rate, the strength of the industrial borrowing becomes less which reduces profit and even its size of expansion. The study recommended that the central Bank of

Nigeria (CBN) should step in with measures to regulate lending rate by maintaining the monetary policy rate at a level low enough to bring down the rate at which deposit money banks lend to their customers.

Imoughele and Ismaila (2021) ^[17] conducted a study to examine the impact of bank lending on the performance of the manufacturing sector in Nigeria covering the period 2000-2016. The specific objective of the study was to investigate the impact commercial bank loans and advances to the manufacturing sector (CBCM), Lending interest rate (LR), savings rate (SR) and money supply (M2) on the performance of the manufacturing sector in Nigeria. Data were obtained from Central Bank of Nigeria (CBN) Statistical Bulletin (various issues). The method of data analysis was Ordinary Least Squares (OLS) technique. Both sectorial distribution of commercial bank loan and advances to the manufacturing sector and saving rate were negative but significant to the output growth rate of the manufacturing sector, while lending rate was negative and non-significant to the output growth rate of the manufacturing sector in Nigeria. Money supply was positive but non-significant to the output growth rate of the manufacturing sector. This implied that for the growth of the manufacturing sector in Nigeria, bank lending interest rate should be low to allow investors to source capital for investment. The study recommended that the monetary authority in Nigeria should therefore reduce the lending interest rate at which Commercial Banks lend to the manufacturing sector.

Ogar, Eja, and Gbenga (2021) ^[14] investigated the relationship between interest rate and the manufacturing sector performance in Nigeria from the period 1981-2016. The specific objective of the study was to examine the relationship among lending interest rate, deposit interest rate, inflation rate and real manufacturing sector output in Nigeria. The pre-estimation tests carried out in the study were Augmented Dickey Fuller unit root test and Johansen cointegration test to verify long run association among the series while the method of data analysis was the vector error correction model as a verification of the short run adjustment. The results established the existence of a long run relationship among the variables; the results equally confirmed a negative but significant relationship between lending rate and manufacturing sector output in Nigeria. A positive but non-significant relationship between deposit rate and the manufacturing sector output was observed. Short run association between the variables was equally recorded. Based on the findings, the study therefore recommended that the Government through the central bank of Nigeria should develop strategies and policies geared at reducing the wide interest rate spread among commercial banks in Nigeria.

Ogero and Musyoka (2021) ^[11] conducted a study to examine the effect of interest rate on Kenya's Economic Performance for the period of 1995-2019. The specific objective of the study was to examine the effect of interest rate and inflation rate on real gross domestic product. The methodology employed in this paper were the descriptive statistics, correlation and regression analysis to examine the effect. The descriptive

results showed that there has been a very high volatility in both interest and inflation rates since 1995 and 2005, respectively, with interest rate hitting as low as 12.53% and as high as 33.79% while inflation rates hitting as low as 1.96 % to as high as 16.30%. GDP growth hit the lowest point of -2.14% and the highest of 4.30. The correlation coefficient technique is employed to establish the strength and direction of the relationship between interest rate and economic performance. The results from regression analysis revealed that interest rate has a negative impact on economic performance in Kenya at 5 percent level ($r=-0.738$, $\text{Beta}=0.437$, $t=1.99$, $p<0.05$). Moreover, the paper revealed that the degree of responsiveness of GDP to changes in the interest rate is large. The study recommended that there is need for the government to control the country's interest rate as it is found that it negatively affects the economic performance of the country.

Adofu and Alhassan (2021) ^[3] investigated the impact of interest rates deregulation on gross domestic investment in Nigeria between 1987-2015. Specifically, the study sought to evaluate the impact of interest rate (INTR), saving level (SAV), exchange rate (EXCR) and dummy variable capturing interest rate deregulation. The data analytical techniques were the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root tests, Engle-Granger and Philips-Ouliaris, as well as Canonical Cointegrating Regression (CCR) technique in analyzing data gotten from CBN bulletin. The result revealed that in the long run, interest rate is inversely but non-significantly related to domestic investment in Nigeria. Meanwhile, the result clearly showed that exchange rate, savings level and deregulation are the significant determinants of investment in Nigeria. This means, the adoption of interest rate deregulation has enormous significant positive impact on the level of domestic investment in the country. The study concluded that although investment does not depend on interest rate alone, interest rates deregulation enhances domestic investment in Nigeria. The study recommended that government should provide monitoring mechanism to be put in place to ensure proper channelling of loanable funds to encourage domestic investment in Nigeria.

2.4 Research gap

Owing to the available literature reviewed in relation to the impact of interest liberalization on the real sector output in Nigeria, most research work failed to use the appropriate data analytical technique that captured the volatility of interest rate. Therefore, the current study will fill the gap by adopting the Generalized Autoregressive Conditional Heteroskedasticity (GARCH), as an appropriate data analytical technique to capture the volatility of interest rate.

In addition, most previous research work failed to anchor their studies on the current theoretical literature that linked interest rate liberalization with the real sector output. The study covered the gap by using current theoretical literature of Mundell-Fleming model of growth that modifies the Keynesian model of an open economy. The theoretical framework portraits that interest rate has indirect influence on the real sector output through investment.

3.1 Methodology

The research design is the ex-post-facto research design. The variables consist of agricultural sector gross domestic product (AGR GDP), manufacturing sector gross domestic product (MANGDP), lending interest rate (LENDING), government expenditure (GEXP), manufacturing sector credits (MANCRE), broad money supply (MS₂), exchange rate (EXCHR) and inflation (INFLA), and were sourced from the Central Bank of Nigeria's (CBN) statistical bulletin, 2021. The study covered a period of 1987 to 2024 as defined in our model specification. The econometric software for the study was e-view version 9 because it is user- friendly software. The data analytical technique was done in three phases, namely pre-estimation, estimation and post-estimation. The pre-estimation tests are: descriptive statistics that described the nature and characteristics of the variables, the Augmented Dickey-Fuller unit root test statistic that identified the stationarity position of the variables, the Johansen Co-integration test that identified whether model variables have a long-run or short-run relationship, or both. The study estimation technique is the Generalized Autoregressive Conditional Heteroskedasticity (GARCH). The post-estimation techniques are the heteroskedasticity ARCH test and histogram normality test.

3.2 Model specification for the study

$$\text{MANGDP/AGR GDP} = f(\text{LENDING}, \text{GEXP}, \text{MANCRE}, \text{MS}_2, \text{EXCHR}, \text{INFLA}) \quad (3.2)$$

Where, MANGDP is manufacturing sector Gross domestic product, AGR GDP is agriculture sector Gross domestic product, LENDING is deposit money bank lending interest rate, GEXP is government expenditure, MANCRE is manufacturing sector credit, MS₂ is broad money supply, EXCHR is exchange rate, and INFLA is inflation. In a linear function, it is represented as follows:

$$\text{MANGDP/AGR GDP} = \beta_0 - \beta_1 \text{LENDING}_t - \beta_2 \text{GEXP}_t + \beta_3 \text{MANCRE}_t + \beta_4 \text{MS}_2 - \beta_5 \text{EXCHR}_t - \beta_6 \text{INFLA}_t + \mu_t \quad (3.3)$$

Where: β_0 = Constant term, β_1 to β_6 = Regression coefficients, μ_t = Error term and t is the period. To reduce the outliers among the variables, all variables will be expressed in logarithmic form.

$$\text{LogMANGDP//AGR GDP} = \beta_0 - \beta_1 \text{LENDING}_t - \beta_3 \text{LogGEXP}_t + \beta_4 \text{LogMANCRE}_t + \beta_5 \text{LogMS}_2 - \beta_6 \text{EXCHR}_t - \beta_7 \text{INFLA}_t + \mu_t \quad (3.4)$$

Where: β_0 = Constant term, β_1 to β_6 = Regression coefficient, U_t = Error term and t is the period. The model is reformulated as the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model. Here, the conditional variance is determined by the residual error terms from the last p periods and the conditional variance from the last q periods. GARCH (p,q).

$$\begin{aligned} \text{LogMANGDP/AGR GDP} = & \alpha_0 + \sum_{i=1}^q \alpha_{i\varepsilon_1^2-q} + \sum_{j=1}^p \text{LENDING}_j h_{t-1} + \sum_{i=1}^q \alpha_{i\varepsilon_2^2-q} + \sum_{j=1}^p \text{GEXP}_j h_{t-1} + \\ & \sum_{i=1}^q \alpha_{i\varepsilon_3^2-q} + \sum_{j=1}^p \text{MANCRE}_j h_{t-1} + \sum_{i=1}^q \alpha_{i\varepsilon_4^2-q} + \sum_{j=1}^p \text{MS2}_j h_{t-1} + \sum_{i=1}^q \alpha_{i\varepsilon_5^2-q} + \sum_{j=1}^p \text{EXCHR}_j h_{t-1} + \\ & \sum_{i=1}^q \alpha_{i\varepsilon_6^2-q} + \sum_{j=1}^p \text{INFLA}_j h_{t-1} + e_t \end{aligned} \quad (3.5)$$

4.1 Data presentation

Table 1: Result of descriptive statistics

	MANGDP	AGR GDP	LENDING	GEXP	MANCRE	MS2	EXCHR	INFLA
Mean	1707382.	347345.6	19.48447	1030184.	1049009.	715076.2	94.66228	20.21579
Median	283184.1	8.391757	19.44500	868586.3	430691.6	466227.8	57.37225	12.65000
Maximum	9719514.	4890270.	30.90000	2707952.	2998939.	1987842.	342.5430	72.80000
Minimum	16392.90	65353.58	9.250000	10164.50	8920.600	5635.900	0.546400	5.400000
Std. Dev.	2650150.	943491.0	5.110360	929255.3	1098078.	683197.1	100.3847	16.75163
Skewness	1.832651	2.783539	0.244781	0.208871	0.514207	0.272588	0.861473	1.511667
Kurtosis	5.065007	9.841074	3.228546	1.400852	1.628299	1.393803	2.792833	4.458459
Jarque-Bera	28.02294	602.8930	0.462181	4.325322	4.653730	4.555383	4.768150	17.84045
Probability	0.000001	0.000000	0.793668	0.115019	0.097601	0.102521	0.092174	0.000134
Sum	64880530	64606274	740.4100	39146975	39862330	27172895	3597.167	768.2000
Sum Sq. Dev.	2.60E+14	1.65E+14	966.2839	3.20E+13	4.46E+13	1.73E+13	372851.9	10382.83
Observations	38	38	38	38	38	38	38	38

Source: Author's computation from e-view application software

Table 1 shows the descriptive statistics of the variables. In the model established in the study, there is one dependent variable and five independent variables. These variables consist of manufacturing sector Gross domestic product (MANGDP), agriculture sector Gross domestic product (AGR GDP), lending real interest rate (LENDING), government expenditure (GEXP), manufacturing sector credits (MANCRE), broad money supply (MS₂), exchange rate (EXCHR) and inflation (INFLA) respectively. The mean of manufacturing sector gross domestic product (MANGDP) is 1707382.0; the median is 283184.1; maximum value is 9719514.6, minimum value is 16392.90, and sum of the variable is 64880530.4, respectively. The mean of agriculture sector GDP (AGR GDP) is 347345.6, the median is 8.391757, maximum value is 4890270.3, minimum value is 65353.58 and sum of the variable is 64606274, respectively. The mean of lending real interest rate (LENDING) is 19.48447, the median is 19.44500, maximum value is 30.90000, minimum value is 9.250000, and sum of

the variable is 740.4100, respectively. The mean of government expenditure (GEXP) is 1030184.99, the median is 868586.3, maximum value is 27077950.0, minimum value is 10164.50, and sum of the variable is 39146975.22, respectively. The mean of manufacturing sector credits (MANCRE) is 1049009.00, the median is 430691.6, maximum value is 2998939.0, minimum value is 8920.600 and sum of the variable is 39862330.44, respectively. The mean of broad money supply (MS₂) is 715076.2, the median is 466227.8, maximum value is 1987842.88, minimum value is 5635.900 and sum of the variable is 27172895.99, respectively. The mean of exchange rate (EXCHR) is 94.66228, the median is 57.37225, maximum value is 56.21000, minimum value is 23.000000 and sum of the variable is 3597.167, respectively. The mean of inflation rate (INFLA) is 20.21579, the median is 12.65000, maximum value is 72.800000, minimum value is 5.400000, and sum of the variable is 768.20000, respectively.

4.2.1 Correlation matrix of the variables

Table 2: Result of correlation matrix

	AGR GDP	MANGDP	LENDING	GEXP	MANCRE	MS2	EXCHR	INFLA
AGR GDP	1	0.0267	0.4610	0.6731	0.7669	0.6833	0.8673	-0.2378
MANGDP	0.0267	1	0.0046	0.4144	0.2972	0.4100	0.2146	-0.0573
LENDING	0.4610	0.0046	1	0.3436	0.3979	0.3445	0.4862	0.0991
GEXP	0.6731	0.4144	0.3436	1	0.9678	0.9946	0.9210	-0.2545
MANCRE	0.7669	0.2972	0.3979	0.9678	1	0.9730	0.9629	-0.2011
MS2	0.6833	0.4100	0.3445	0.9946	0.9730	1	0.9264	-0.2433
EXCHR	0.8673	0.2146	0.4862	0.9210	0.9629	0.9264	1	-0.2493
INFLA	-0.2378	-0.0573	0.0991	-0.2545	-0.2011	-0.2433	-0.2493	1

Source: Author's computation from e-view application software

Table 2 presents a correlation matrix that outlines the correlation coefficients between different sets of variables. Each random variable (X_i) is assessed in relation to every other variable (X_j) within the table. The analysis reveals no linear relationship between the Gross Domestic Product of the agriculture sector (AGR GDP) and that of the manufacturing sector (MANGDP), with a coefficient of 0.0267. Similarly, there is no linear correlation between AGR GDP and the lending real interest rate (LENDING), indicated by a coefficient of 0.4610. Furthermore, the correlation between AGR GDP and government expenditure (GEXP) is not perfect, as evidenced by a coefficient of 0.6731. The relationship between AGR GDP and manufacturing sector credits

(MANCRE) also lacks perfection, with a coefficient of 0.7669. Additionally, there is no perfect linear relationship between AGR GDP and the broad money supply (MS2), which has a coefficient of 0.6833. The correlation with the exchange rate (EXCHR) is similarly imperfect, with a coefficient of 0.8673, and the relationship with the inflation rate (INFLA) shows no perfect correlation either, with a coefficient of 0.2378. This analysis provides a clear understanding of the ordinary least squares assumption, indicating that there are no perfect or exact linear relationships among the explanatory variables. The results of the correlation matrix confirm that all explanatory variables in this study are linearly independent of one another.

4.2.2 Unit root test using augmented dickey-fuller test

Table 3: Results of stationarity (unit root) test

Variables	Variables' Name	ADF- Statistic	5% Critical Value	Remark
AGR GDP	Agriculture GDP	-7.617025	-2.945842	1 (1)
MANGDP	Manufacturing GDP	-4.617025	-2.945842	1 (1)
LENDING	Deposit Money bank Lending Rate	-8.259902	-2.945842	1 (1)
GEXP	Government Expenditure	-7.109700	-2.945842	1 (1)
MANCRE	Manufacturing Credits	-6.704722	-2.945842	1 (1)
MS2	Broad Money Supply	-5.225493	-2.945842	1 (1)
EXCHR	Exchange Rate	-5.090027	-2.945842	1 (1)
INFLA	Inflation Rate	-3.053066	-2.945842	1 (1)

Source: Author's computation

In Table 3, the variables analyzed for unit root presence are displayed, along with their respective Augmented Dickey-Fuller (ADF) statistic values and the lag levels assigned to each variable. The table also highlights the Mackinnon critical values at a 5% significance level. Each variable's order of integration is specified, and their stationarity status is noted. A variable is considered stationary if the absolute value of the Augmented Dickey-Fuller statistic surpasses the Mackinnon critical value at the 5% level. The variables examined include the Gross Domestic Product (GDP) of the agriculture sector

(AGR GDP), the GDP of the manufacturing sector (MANGDP), the lending real interest rate (LENDING), government expenditure (GEXP), manufacturing sector credits (MANCRE), broad money supply (MS2), exchange rate (EXCHR), and inflation (INFLA). All these variables were determined to be stationary at first difference, indicating they are I(1) processes. Thus, they contain a unit root. The identification of unit roots in most variables opens avenues for further analysis regarding the long-term relationships among them.

4.2.3 Co-integration test results

Ho = There is no co-integration (no long run relationship among variable)

Table 4: Co-integration test results

Date: 09/03/25 Time: 09:38				
Sample (adjusted): 1988 2024				
Included observations: 36 after adjustments				
Trend assumption: Linear deterministic trend				
Series: AGR GDP MANGDP LENDING MANCRE GEXP MS2 INFLA EXCHR				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.752483	127.4764	125.6154	0.0383
At most 1	0.588681	77.21041	95.75366	0.0622
At most 2	0.386439	75.22848	69.81889	0.0235
At most 3	0.310079	27.64338	47.85613	0.8288
At most 4	0.187098	14.28094	29.79707	0.8245
At most 5	0.167702	6.823738	15.49471	0.5982
At most 6	0.005965	0.215390	3.841466	0.6426

Source: e-view results

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level,

**MacKinnon-Haug-Michelis (1999) p -values, Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

The co-integration analysis presented in table 4 for the model comprising AGRGDP, MANGDP, LENDING, GEXP, MANCRE, MS2, EXCHR, and INFLA indicates that both trace tests identify three co-integrating equations at the 5 percent significance level. This finding suggests the existence

of a long-term relationship among the variables in question. Consequently, we reject the null hypothesis asserting the absence of co-integration among these variables and accept the alternative hypothesis.

4.3 Presentation of data and analysis

Table 5: Empirical results of the Autoregressive Conditional Heteroskedasticity Model (ARCH)

Dependent Variable: LOGMANGDP				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 09/03/25 Time: 10:01				
Sample: 1987 2024				
Included observations: 38				
Failure to improve likelihood (non-zero gradients) after 58 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LENDING	-0.012012	0.036083	-0.332902	0.7392
LOGGEXP	0.991811	0.421176	2.354860	0.0185
LOGMANCRE	0.512585	0.318604	1.608846	0.1077
LOGMS2	0.453923	0.409488	1.108513	0.2676
EXCHR	-0.005406	0.004512	-1.198196	0.2308
INFLA	-0.011248	0.007142	-1.574952	0.1153
C	0.638240	2.185547	0.292027	0.7703
Variance Equation				
C	0.181489	0.231482	0.784031	0.4330
RESID(-1)^2	1.369450	0.620802	2.205935	0.0274
GARCH(-1)	-0.025407	0.072638	-0.349780	0.7265
R-squared	0.869434	Mean dependent var		13.07133
Adjusted R-squared	0.747389	S.D. dependent var		1.778272
S.E. of regression	1.542708	Akaike info criterion		2.818091
Sum squared resid	73.77834	Schwarz criterion		3.249034
Log likelihood	-43.54372	Hannan-Quinn criter.		2.971417
Durbin-Watson stat	0.667165	-	-	-

Source: E-view results

The Autoregressive Conditional Heteroskedasticity model was carried out to examine the parameter estimates. In testing this hypothesis, lending real interest rate (LENDING), government expenditure (GEXP), manufacturing sector credits (MANCRE), broad money supply (MS₂), exchange rate (EXCHR) and inflation (INFLA) were regressed against manufacturing sector gross domestic product (MANGDP). The result of the regression analysis represents the model for the impact of interest rate liberalization on manufacturing sector output in Nigeria. The empirical result shows that the coefficient of lending real interest rate (LENDING) has a negative and non-significant impact on the manufacturing sector gross domestic product (MANGDP) because the Z-statistics (-0.332902), its probability value of 0.7392 is greater than 0.05. The empirical result shows that the coefficient of government expenditure (GEXP) has a positive and significant impact on the manufacturing sector gross domestic product (MANGDP) because the Z-statistics (2.354860), its probability value of 0.0185 is less than 0.05. The empirical result shows that the coefficient of manufacturing sector credits

(MANCRE) has a positive and non-significant impact on the manufacturing sector gross domestic product (MANGDP) because the Z-statistics (1.608846), its probability value of 0.1077 is less than 0.05. The empirical result shows that the coefficient of broad money supply (MS₂) has a positive and non-significant impact on the manufacturing sector gross domestic product (MANGDP) because the Z-statistics (1.108513), its probability value of 0.2308 is less than 0.05. The empirical result shows that the coefficient of Inflation rate (INFLA) has a negative and non-significant impact on the manufacturing sector gross domestic product (MANGDP) because the Z-statistics (-1.574952), its probability value of 0.1153 is less than 0.05. The empirical result shows that the coefficient of exchange rate (EXCHR) has a negative and non-significant impact on the manufacturing sector Gross domestic product (MANGDP) because the Z-statistics (-1.198196), its probability value of 0.2308 is less than 0.05. Again, our empirical result shows that the R-squared (R²) is 0.8881.

4.3.2 Estimation of regression model two

Table 6: Empirical results of the Autoregressive Conditional Heteroskedasticity Model (ARCH)

Dependent Variable: LOGAGRGDP				
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)				
Date: 09/03/25 Time: 13:48				
Sample: 1987 2024				
Included observations: 38				
Failure to improve likelihood (non-zero gradients) after 59 iterations				
Coefficient covariance computed using outer product of gradients				
Presample variance: backcast (parameter = 0.7)				
GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
LENDING	-0.018210	0.014901	-1.222061	0.2217
LOGGEXP	0.950881	0.090223	10.53926	0.0000
LOGMANCRE	0.093230	0.140557	0.663287	0.5071
LOGMS2	0.111185	0.121162	0.917658	0.3588
INFLA	-0.003770	0.004559	-0.826990	0.4082
EXCHR	-0.007060	0.002934	-2.406545	0.0161
C	2.260641	1.282922	1.762104	0.0781
Variance Equation				
C	0.027655	0.037804	0.731545	0.4644
RESID(-1)^2	-0.240696	0.129342	-1.860926	0.0628
GARCH(-1)	1.029811	0.245836	4.189014	0.0000
R-squared	0.968381	Mean dependent var		12.75702
Adjusted R-squared	0.962262	S.D. dependent var		2.115695
S.E. of regression	0.411002	Akaike info criterion		1.021736
Sum squared resid	5.236599	Schwarz criterion		1.452679
Log likelihood	-9.412977	Hannan-Quinn criter.		1.175062
Durbin-Watson stat	1.299766	-	-	-

Source: E-view results

The Autoregressive Conditional Heteroskedasticity model was carried out to examine parameter estimates. In testing this hypothesis, lending real interest rate (LENDING), government expenditure (GEXP), manufacturing sector credits (MANCRE), broad money supply (MS₂), exchange rate (EXCHR) and inflation (INFLA) were regressed against the agricultural sector gross domestic product (AGRGDP). The result of the regression analysis represents the model for the impact of interest rate liberalization on the agricultural sector output in Nigeria. The empirical result shows that the coefficient of lending real interest rate (LENDING) has a negative and non-significant impact on the agricultural sector gross domestic product (AGRGDP) because the Z-statistics (-0.332902), its probability value of 0.7392 is greater than 0.05. The empirical result shows that the coefficient of government expenditure (GEXP) has a positive and significant impact on the agricultural sector gross domestic product (AGRGDP) because the Z-statistics (10.5392), its probability value of 0.0000 is less than 0.05. The empirical result shows that the coefficient of manufacturing sector credit has a positive and non-significant impact on the agricultural sector gross domestic product (AGRGDP) because the Z-statistics (0.6632), its probability value of 0.5071 is greater than 0.05. The empirical result shows that the coefficient of broad money supply (MS₂) has a positive and non-significant impact on the agricultural sector gross domestic product (AGRGDP) because the Z-statistics (0.91765), its probability value of 0.3588 is less than 0.05. The empirical result shows that the coefficient of

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inflation rate (INFLA) has a negative and non-significant impact on the agricultural sector gross domestic product (AGRGDP) because the Z-statistics (-0.8269), its probability value of 0.4082 is less than 0.05. The empirical result shows that the coefficient of exchange rate (EXCHR) has a negative and significant impact on agricultural sector gross domestic product (AGRGDP) because the Z-statistics (-2.4065), its probability value of 0.0161 is less than 0.05. Again, our empirical result shows that the R-squared (R²) is 0.9681.

4.3.3 Econometric/second order test

The null hypothesis; there is no heteroskedasticity

Table 4.6: Result of heteroskedasticity test arch

Heteroskedasticity Test: ARCH			
F-statistic	0.933557	Prob. F(1,35)	0.3406
Obs*R-squared	0.961264	Prob. Chi-Square (1)	0.3269
Test Equation			
Dependent Variable: WGT_RESID^2			
Method: Least Squares			
Date: 09/11/24 Time: 11:54			
Included observations: 37 after adjustments			

Source: E-view results

The heteroskedasticity ARCH test was conducted to ascertain if the model was impacted by heteroskedasticity issues. Such issues violate the ordinary least squares assumption, which

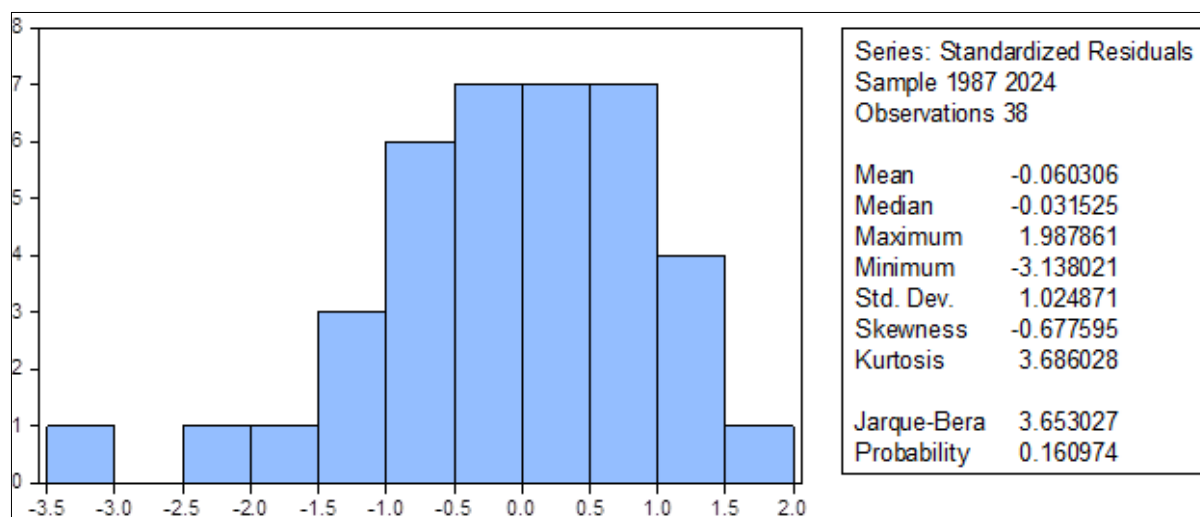
asserts that the error term should exhibit constant variance. This test acts as a statistical safeguard to ensure that the ordinary least squares assumption is not violated.

According to the null hypothesis, there is no presence of heteroskedasticity, supported by the Prob. Value of the heteroskedasticity ARCH Test (0.3406), which is higher than the critical value of 0.05. Therefore, we reject the alternative hypothesis in favor of the null hypothesis. This finding indicates that the model is free from heteroskedasticity issues,

implying that the predictions based on the Ordinary Least Squares estimates are efficient and unbiased.

4.3.4 Histogram normality test

A normality test is done to check if the residuals of the error term follow a normal distribution. The test is conducted using the Jacques-Bera (JB) test. In testing for normality, the approach used by Paavola (2006) for testing normality using the Jacques-Bera test was adopted.



Source: E-view 9.0 version

Fig: 5 presents the normality test for each of the distribution

The Jarque-Bera (JB) test serves as a statistical tool for assessing both skewness and kurtosis. Skewness reflects the symmetry of a distribution, with a value of zero indicating a normal distribution. Conversely, kurtosis quantifies the peakedness of a distribution, where a normal distribution is characterized by a kurtosis value of three. A distribution is deemed skewed if one tail is longer than the other, which can be classified as either positive or negative skewness. A positively skewed distribution has a longer tail extending towards the positive side, while a negatively skewed distribution has a longer tail towards the negative side. The null hypothesis suggests that the model exhibits skewness and kurtosis. However, we reject this null hypothesis and accept the alternative hypothesis, which states that there is no skewness or kurtosis present, as the p-value from the Jarque-Bera (JB) test (0.1609) is greater than the 5% significance threshold (0.05). This finding indicates that the standardized residuals from the regression model conform to a normal distribution, consistent with the assumptions underlying ordinary least squares (OLS) estimation.

4.4 Test of hypotheses

The results for the various hypotheses testing are presented in the section.

4.4.1 Test of hypothesis one

H₀₁ Real interest rate liberalization has no significant impact on the manufacturing sector output in Nigeria

In testing this hypothesis, real interest rate liberalization was

regressed against the manufacturing sector output in Nigeria. The empirical result shows that the coefficient of lending real interest rate (LENDING) has a negative and non-significant impact on the manufacturing sector gross domestic product (MANGDP) because the Z-statistics (-0.332902), its probability value of 0.7392 is greater than 0.05. The empirical finding reveals that real interest rate liberalization has a negative and non-significant impact on the manufacturing sector output in Nigeria.

4.4.2 Test of hypothesis two

H₀₁ real interest rate liberalization has no significant impact on the agricultural sector output in Nigeria

In testing this hypothesis, real interest rate liberalization was regressed against the agricultural sector output in Nigeria. The empirical result shows that the coefficient of lending real interest rate (LENDING) has a negative and non-significant impact on the agricultural sector gross domestic product (MANGDP) because the Z-statistics (-1.2220), its probability value of 0.2217 is greater than 0.05. The empirical finding reveals that real interest rate liberalization has a negative and non-significant impact on the agricultural sector output in Nigeria.

4.5 Discussion of the results

4.5.1 Impact of real interest rate liberalization on the manufacturing sector output in Nigeria

It was observed from the hypothesis tested that real interest rate liberalization had a negative and non-significant impact on the

manufacturing sector output in Nigeria (Z–statistics (-0.332902), its probability value of $0.7392 > 0.05$). The finding of this study is in line with study of Berko, Hammond and Amissah (2022) ^[6] that investigated the effect of interest rate spread on economic growth in Ghana using annual time series data from 1975 to 2018. Specifically, the study sought to evaluate interest rate spread (IRS), capital stock (K), labour force cost (LAF), government expenditure (GEXP), export value (EXPT) on economic growth. The study used the Engel-granger two-step procedure which uses the OLS technique to establish both the long-run and short-run relationships between interest rate spread and economic growth. The study established that interest rate spread is a statistically important determinant of economic growth but it has a negative impact in the long-run. Also, the result showed that labour force, capital stock, and exports affect economic growth in Ghana positively both in the long-run and short-run.

4.5.2 Impact of real interest rate liberalization on the agricultural sector output in Nigeria

It was observed from the hypothesis tested that real interest rate liberalization has a negative and non-significant impact on manufacturing sector in Nigeria (Z–statistics (-1.2220), its probability value of $0.2217 > 0.05$). The finding of this study is in line with study of Ogero and Musyoka, (2021) ^[11] that conducted a study to examine the effect of interest rate on Kenya's economic performance for the period of 1995–2019. The specific objective of the study was to examine the effect of interest rate and inflation rate on real gross domestic product. The methodology employed in the paper included the descriptive statistics, correlation and regression analysis to examine the effect. The descriptive results showed that there has been a very high volatility in both interest and inflation rates since 1995 and 2005, respectively with interest rate hitting as low as 12.53% and as high as 33.79% while inflation rates hitting as low as 1.96 % to as high as 16.30%. GDP growth hit the lowest point of -2.14% and the highest of 4.30. The correlation coefficient technique was employed to establish the strength and direction of the relationship between interest rate and economic performance. The results from regression analysis revealed that interest rate has a negative impact on the economic performance in Kenya at 5 percent level ($r=-0.738$, $Beta=0.437$, $t=1.99$, $p<0.05$). Moreover, the paper revealed that the degree of responsiveness of GDP to changes in the interest rate is large.

5.1 Summary of findings

The following are the major findings of the study:

- Real interest rate liberalization has a negative and non-significant impact on the manufacturing sector output in Nigeria (Z–statistics (-0.332902), Prob-value of $0.7392 > \text{Sig-value } 0.05$). The real interest rate liberalization has a 1.2 percent positive and non-significant impact on the manufacturing sector output in Nigeria. A percent change in the real interest rate liberalization results in a 1.2 percent increase in the manufacturing sector output in Nigeria.

- Real interest rate liberalization has a negative and non-significant impact on the agricultural sector output in Nigeria (Z–statistics (-1.2220), Prob-value of $0.2217 > \text{Sig-value } 0.05$). The real interest rate liberalization has a 1.8 percent positive and non-significant impact on the agricultural sector output in Nigeria. A percent change in the real interest rate liberalization results in a 1.8 percent increase in the agricultural sector output in Nigeria.

5.2 Conclusion

This study concludes that real interest rate liberalization has a negative and non-significant impact on the real sector output in Nigeria. The study conforms to Mundell-Fleming model of growth that interest rates and credit to private sector determine investment in the economy. The model states that aggregate income Y is the sum of consumption from disposable income, investment which is a function of interest rate and the relationship is negatively sloped, government expenditure and net exports which also depends negatively on exchange rate due to capital account liberalization. In the model, price level and money supply are assumed to be fixed. Under a fluctuating exchange rate system, a small open economy with perfect capital mobility, expansionary fiscal policies will crowd out net exports causing exchange rate to rise.

5.3 Recommendations of the study

Based on the findings of this study, the following recommendations were made.

- The Nigerian government, through the central bank, should consolidate the gains of financial sector liberalization by implementing policies that enhance credit access for the private sector in order to stimulate the real sector output growth. Furthermore, banks should be incentivized to lower lending rates and borrowing costs to encourage domestic investment.
- The Central Bank of Nigeria should increase the savings deposit rate to incentivize savings within the surplus sector of the economy. Additionally, it is essential for government policies to better support the private sector, fostering an increase in their financial investments to drive economic growth in Nigeria.

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