Effect of Deposit Money Bank's Credit on Manufacturing Sector Output in Nigeria

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ABSTRACT

This study examines the effect of bank credit, lending rate and inflation rate on the manufacturing sector's output in Nigeria for the periods between 1981 and 2022. Data were obtained from Central Bank of Nigeria (CBN) Statistical Annual Bulletin. The study employed descriptive analysis techniques and Autoregressive Distributed Lagged modelling approach. Empirical findings from the descriptive analysis revealed significant increasing trend in the time series plots of manufacturing sector output, deposit money banks' credit to manufacturing sector, lending rate and inflation rate of Nigeria. The study's empirical findings showed that deposit money banks' credit to manufacturing sector, lending rate and inflation rate significantly cointegrate with the country manufacturing sector output. Explicitly, this study found that deposit money banks' credit to manufacturing sector significantly and positively impacts the manufacturing sector output both in the short-run and long-run, which could be interconnected to the significant positive impact of lending rate on deposit money banks' credit. Similarly, this study found that the inflation rate significantly and negatively impacts the manufacturing sector output both in short-run and long-run, which also could be connected to the significant positive impact of lending rate on inflation rate. Among other recommendations, this study suggests government and policymakers should address the rising lending rate in real time by developing and implementing apt fiscal policies to regulate the lending rate in order to make the manufacturing sector more attractive for productivity and lessen the double figure inflation rate of the country.

INTRODUCTION

Background to the Study

Arguably, the expansion of financial services and manufacturing among other sectors distinguished Nigerian economy as an emerging market. In recent years, the federal government appropriations bills have been concentrated on sustainable growth, and the manufacturing sector is critical in accomplishing this goal. The manufacturing sector is a major driver of import substitution which enhances exportations, foreign exchange earnings, employment creation, consumption patterns and standards of living. The sector plays a crucial role in promoting long-term growth. (Hacievliyagii and Eksi, 2019). The employment, income, innovation, and "multiplier effects" generated by this particular sector have the potential to spark growth in other areas of the economy. As a result, many of the other Sustainable Development Goals (SDGs) outlined in the United Nations' Agenda 2030 depend on progress made towards SDG (United Nations Industrial Development Organization, 2022). To accentuate the vital role of the manufacturing sector on the country's Gross Domestic Product (GDP), both the fiscal and monetary authorities in Nigeria have over the years established intervention funds targeted at revamping the sector and ramping up production. Deposit Money Banks (DMBs) serves as veritable source in which credits are channeled to the manufacturing sector via their intermediation role. Given their intermediation role, the Federal Government of Nigeria and Central Bank of Nigeria intervention funds for the manufacturing sector and other subsectors are channeled through DMBs (as participating banks). Even with the adoption of various reforms in the banking industry, the manufacturing sector in Nigeria continues to encounter a decrease in its contribution to the growth of the economy due to challenges in obtaining financial resources (Eke et al., 2023). According to the Nigeria Bureau of Statistics (2022), the manufacturing sector's contribution to GDP fell in the second quarter of 2022 by 8.65%, as compared to the second quarter of 2021, which recorded a contribution of 8.69%. Additionally, the contribution in the second quarter of 2022 was

lower than the contribution of 10.20% documented in the first quarter of 2022. Foreign exchange fluctuations, a high lending rate, and rising prices for raw materials and industrial inputs have all been cited by industry players as reasons for the downturn performance of the manufacturing sector (Nigerian Economic Summit Group NESG, 2018).

The manufacturing sector underwent a period of significant expansion for more than ten years, primarily driven by a small number of sub-sectors, until the year 2015 (Adetunji, 2019). During the period spanning from 2005 to 2014, the industry mentioned above experienced a yearly mean growth rate of 12%, primarily driven by a surge in consumer demand. Foreign exchange restriction and exchange rate depreciation became the new normal for the country when the oil boom era ended (NESG, 2018). However, manufacturing production is still impacted by structural issues, which go beyond currency fluctuations (Eke et al., 2023). The manufacturing sector is faced with numerous economy operational imbalances such as infrastructural deficit, tariff and non-tariff barriers to trade, investment obstacle, multiple exchange rate regime and limited foreign exchange rate capacity. The manufacturing sector in Nigeria has encountered a myriad of challenges. These challenges include low productivity, limited locally available resources, insufficient innovation and technical knowledge, deficient infrastructure, disorganized local supplier foundations, and inadequate coordination between suppliers and downstream purchasers. Additionally, financial constraints further aggravate these challenges.

Given the numerous financial obstacles, the manufacturing sector encounters and other several; challenges like lack of infrastructure, high cost of raw materials, security issues, high energy cost, multiple taxation, and lack of technological advancement, it becomes imperative to reassess the relationship between bank credit and the development of the manufacturing sector in Nigeria. Furthermore, certain studies (Audu et al., 2021) have demonstrated a significant relationship between manufacturing output and deposit money bank credit allocated to the manufacturing sector. Conversely, other studies (Andabai and Eze, 2018; Akpan et al., 2016) have found an insignificant relationship. This study contributes to the existing literature by employing a rigorous methodology to re-evaluate the relationship in the specific context of Nigeria. Additionally, the manufacturing output data is subject to daily updates, and frequent changes, necessitating empirical evidence, characterize the sector. Thus, this study aims to analyze the effect of bank credit on the output of the manufacturing sector in Nigeria from 1981 to 2021.

Objectives of the Study

The primary focus of this study is to examine the effect of bank credit, inflation rate and bank lending rate on the manufacturing sector's output in Nigeria. The specific objectives of the study are to;

1. Assess the trend of deposit money bank credit, inflation rate, bank lending rate and the output of manufacturing sector in Nigeria between the year 1981 and 2022.
2. Examine the causal relationship between the deposit money bank credit, inflation rate, bank lending rate and the output of manufacturing sector in Nigeria.
3. Assess the short or/and long-run impact of deposit money bank credit, inflation rate and bank lending rate on the country’s manufacturing sector outputs.

Empirical Literature

Consequent to the significant role of manufacturing sector in country’s economy growth, the sector has over the years gained numerous attentions in literature. Ifenowo (2019) delved into the effects of bank credits on the performance of the manufacturing sector in Nigeria over a ten-year period from 2006 to 2016. Based on the Ordinary Least Square method, the study discovered a lack of significant correlation between bank credits to the manufacturing sector and manufacturing output. The research found that providing sufficient financing to the manufacturing sector could boost its growth and, consequently, contribute to the overall economic expansion. Consequently, the study suggested increasing financing for the manufacturing sector to enhance its impact on economic growth and job creation. It is apparent that the study is limited to manufacturing sector output, and bank loans. Also the study did not consider the short and long term relationship between the variables. Similarly, Attah et al. (2019) examined the relationship between bank loans and manufacturing

output in Nigeria from 1986 to 2017. By employing Granger's causality analysis, they demonstrated the existence of a distinct long-term equilibrium relationship between bank loan and output in the manufacturing sector. The study also demonstrated that both the positive and negative aspects of bank lending had a substantial influence on manufacturing production. It was discovered that there is a causal relationship between bank credit and manufacturing output in Nigeria, suggesting a possibility of the supply-leading hypothesis. Based on their research, the study strictly identified the causality relationship between bank loans and manufacturing output without examining the short- and long-term relationship of the variables.

Moreover, the relationship between private sector loan and manufacturing capacity in Nigeria was studied by Chinanu Ife et al. (2019). This research used quarterly time series data that was collected between 1981 and 2015. This research used the granger causality method proposed by Toda and Yamamoto to establish whether or not there is a long-term correlation between manufacturing productivity and private sector loan availability. Access to credit in the private sector is causally related to manufacturing production in Nigeria, according to a Toda Yamamoto Granger causality test. However, it is of important to note that the study strictly centered on influence of private loans on manufacturing capacity of the country. Also, Akinmulegun and Akinde (2019) studied how financial deepening affected Nigeria's manufacturing industries. The Error Correction Model (ECM) indicated that the manufacturing sector benefited from a higher ratio of lending to the private sector. However, the manufacturing sector's output suffered because of the interest rate variations. This study did consider how loans administered by deposit money banks have impacted manufacturing sector output in Nigeria, however it failed to consider other appropriate macroeconomic variables such as interest rate, inflation rate as well as lending rate. In addition, Elijah (2018) analyzed the influence of bank credits on the outputs of the manufacturing sector within the Nigerian economy from 1986 to 2016. The collected data underwent analysis through the utilization of Autoregressive Distributed Lag (ARDL) models. Research revealed that the provision of credit by banks has had a positive impact on the output of the manufacturing sector. The study was however limited to bank credits and the outputs of the manufacturing sector.

Anyanwaokoro and Ogbu (2018) conducted a study that examined the impact of commercial bank loans on the productivity of Nigeria's manufacturing sectors between 1986 and 2016. Their findings were consistent with previous research. The findings indicated a significant increase in productivity in Nigeria's manufacturing sectors following the provision of loans from commercial banks. Thus, it was proposed that increased funding be allocated to the agricultural and manufacturing sectors to enhance their productivity. Similarly, the research by Anyanwaokoro, and Ogbu (2018) was limited to just the relationship between bank credits and the output of manufacturing sector without considering the effect of some macroeconomic variables like interest rate, inflation rate and lending rate. Similarly, Messaging et al. (2018) used yearly data from 1981–2015 to examine the relationship between financial development and growth in the manufacturing sector in Nigeria. Based on the findings of the error correction model, it is evident that there is a long-term relationship between the variables. In addition, there are short-run estimates that suggest a strong correlation between credit to the private sector and manufacturing sector output. On the other hand, it was observed that interest rates have a negative impact on manufacturing sector output. Meanwhile, over time, no significant connection is found between interest rates, bank credit, and manufacturing sector output. It is apparent that the findings of the study were apt but novel. The study limited its scope to error correction modelling without not considering the short- and long-term relationship between the variables.

Contrary to the above findings, Andabai and Eze (2018) have indicated that bank credit does not exert an important effect on the manufacturing sector within the context of Nigeria. Andabai and Eze (2018) conducted an analysis on the relationship between bank loans and the growth of Nigeria’s manufacturing sector from 1990 to 2016. According to the results of the Vector Error Correction Model analysis, bank loans to the manufacturing sector has no significant influence on manufacturing sector output in Nigeria. Using ordinary least square (OLS) methodologies, Anyaegbuna et al. (2018) investigates the effects of a subset of macroeconomic variables on manufacturing productivity in Nigeria from 1981 to 2015. According to the study’s findings, inflation rate has little bearing on manufacturing productivity in Nigeria, while domestic investment and lending to this sector have a major impact. Nevertheless, the study by Anyaegbuna et al. (2018) did not analyze the impact of lending rate by banks on manufacturing sector output in Nigeria. While all the findings of Anyaegbuna et al. (2018) were remarkable, the time frame is quite outdated and the variance forecast decomposition of the manufacturing sector output was not examined.

In recent time, Yua et al. (2020) analyzed the relationship between loans provided by commercial banks and the performance of the manufacturing sector in emerging economies, specifically focusing on Nigeria. Theories of interest rates and loan pricing from the neoclassical school provided the theoretical groundwork for the research. The research showed that the lending practices of commercial banks significantly impacted the output of the manufacturing sector. Commercial bank loans improved manufacturing output in developing nations. However, the study failed to adequately take into consideration country specific effects which could have influenced the outcome of the research. The study conducted by Ibrahim et al. (2021) utilized the nonlinear autoregressive distributed lag (ARDL) model and Granger causality to investigate the relationship between bank lending and manufacturing sector output in Nigeria from 1981 to 2019. The results of the analysis showed that increases in bank credit have a positive correlation with manufacturing output in the short run, whereas decreases in bank credit have a negative correlation with manufacturing output in the long term. In the immediate term, it seems that bank loans and interest rates do not have a substantial effect on manufacturing output. Apparently, the study examined the short- and long-term relationship however the study is limited to manufacturing sector output, interest rate, and bank loans.

Furthermore, Audu et al. (2021) studied how access to bank credit affected Nigeria's manufacturing industry from 1986 to 2017. The study utilized ARDL model (Auto Regressive Distributed Lagged). The findings showed that manufacturing production is positively correlated with bank lending to the manufacturing sector. Similarly, the study examined the short- and long-term relationship however the study is limited to manufacturing sector output, and bank loans. Olurinola (2022) examined the effect of credit on the manufacturing sector and its impact on output growth in Nigeria from 1995-2020. The results show that a decline in lending rate will lead to an increase in bank credit, as economic agents take advantage of the lower cost of funds. Additionally, a reduction in the interest rate will lead to an increase in investment in the manufacturing sector, which will in turn improve manufacturing sector performance. Equally, while the study revealed that lower lending rate will lead to an increase in bank credit, the study is limited to three variables namely lending rate, bank credit and manufacturing output and failed to assessed the relationship between the variables in short and long term. Oparah et al. (2023) employed the Ordinary Least Square (OLS) technique to analyze the effects of bank lending on Nigeria's manufacturing subsector from 1999 to 2022. The Ordinary Least Square's findings show that bank lending rates and credit provided by banks to the manufacturing sector have a favorable effect on Nigeria's manufacturing sectors. Bank credit's effect on Nigeria's manufacturing sector's productivity has been examined by Onyia and Okafor, (2023). The research revealed that the overall amount of credit extended to the private sector positively and significantly impacted the output of the manufacturing sector. This study supports the conclusions made by Oparah et al. (2023) and Onyia, and Okafor (2023) that loan from financial institutions causes the industrial sector's production to rise. This study's primary goal was to explore the effect of deposit money bank's credit on Nigeria's manufacturing sector (1981-2022). This stands in contrast to the most recent research evaluated by Audu (2021), which had a scope of work completed in 2017 and a restricted length of time as well as Achi (2023) who analyzed the economic factors that affect the productivity of Nigeria's manufacturing industry. However, Achi (2023) did not incorporate the short and long terms relationship assessment between the variables. Therefore, conducting a study on the impact of DMBs credit have on the performance of the manufacturing sector will give the most recent empirical knowledge on changes in the manufacturing sector in Nigeria.

METHODOLOGY

Model Specification

The study model specification pursues to estimate the relationship between Manufacturing Sector Output (MANO) and the independent variables; Deposit Money Banks' Credits to Manufacturing Sector (DMBC), Lending Rate (LENR) and Inflation rate (INFL). As a conditional autoregressive distributed lag (ARDL), the model can be stated as:

$$\Delta MANO_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta MANO_{t-i} + \sum_{i=1}^{q_1} \alpha_{2i} \Delta DMBC_{t-i} + \sum_{i=1}^{q_2} \alpha_{3i} \Delta LENR_{t-i} + \sum_{i=1}^{q_3} \alpha_{4i} \Delta INFL_{t-i} + \beta_1 MANO_{t-1} + \beta_2 DMBC_{t-1} + \beta_3 LENR_{t-1} + \beta_4 INFL_{t-1} + \varepsilon_t \quad (1)$$

Where Δ is the first difference operator p, q_1, q_2, q_3 and q_4 are the lag lengths.

Estimation Procedure: Methods of Data Analysis

Regression Model (Ordinary Least Square Method)

A priori Expectation: $C > 0$, $\beta_1 > 0, \beta_2 > 0$.

The ordinary Least Square (OLS) technique will be employed in obtaining the numerical estimates of the coefficients of the equation. The OLS method is chosen because it possesses some optimal properties; its computational procedure is fairly simple and it is also an essential component of most other estimation techniques. The regression model is given as

$$Y_i = \beta_0 + \beta_i X_i + \varepsilon_i, \qquad i = 1,2, \dots, n \tag{2}$$

where Y_i and X_i are the dependent and independent in the ith observations respectively. β_0 and β_i are unknown and are usually obtained by method of Least Square, and ε_i is the error term.

Augmented Dickey-Fuller (ADF) Test

In time series analysis, it is a tradition that the unit root hypothesis is first tested for each of the variables to ascertain the level of variable stationarity. This study utilized the Augmented Dickey–Fuller (ADF) test that is based on the following regression:

$$\Delta y_t = \varphi + \beta_t + \alpha y_{t-1} + \sum_{i=1}^{k} d_i \Delta y_{t-1} + \varepsilon_t \tag{3}$$

Where ε_t is a white noise error term and $\Delta y_{t-1} = y_{t-1} - y_{t-2}$, $\Delta y_{t-2} = y_{t-2} - y_{t-3}$, etc.
The number of lagged-difference terms to include is often determined empirically, in order to have enough terms so that the error terms in equation (3) are serially uncorrelated. k in equation (3) is the lagged values of Δy_t, to control for higher-order correlation assuming that the series follow an AP(p). Thus, equation (3) tests the null hypothesis of a unit root against a stationary alternative for each of the time series variable of the study.

Granger Causality Test

The Granger causality test was used to statistically test and determine the hypothesis of whether one time series is useful in forecasting another, as proposed in Granger (1969). A time series variable y is said to granger-cause z if lagged values of y (and with lagged values of z also included), provide statistically significant information about forecast values of z. To test for the granger-cause, we first found the appropriate lagged values of y using the Akaike Information Criteria (AIC) to include in the univariate autoregression of y:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots + \beta_p Y_{t-p} + \varepsilon_t \tag{4}$$

Then, the autoregression is augmented by comprising lagged values of x

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots + \beta_p Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \cdots + \alpha_q X_{t-q} + \varepsilon_t$$

The null hypothesis that y does not granger-cause z is accepted if and only if no lagged values of y are retained in the regression.

Autoregressive Distributed Lagged (ARDL) Model

The autoregressive distributed lag (ARDL) is adopted in this study to assess the possibility of short-run or long-run cointegration between the time series variables. ARDL model is a standard ordinary least squares regression, which include the lags of both the dependent variable and independent variables as regressors (Erdoğdu and Çiçek 2017). The basic form of an ARDL (p, q) regression model is given as;

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots + \beta_p Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \cdots + \alpha_q X_{t-q} + \varepsilon_t$$
$$Y_t = \beta_0 + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{i=0}^{q} \alpha_i X_{t-i} + \varepsilon_t \tag{5}$$

Where ε_t is a disturbance term, the dependent variable is a function of its lagged values, the current and lagged values of other exogenous variables in the model; p lags are used for dependent variable while q lags are for

exogenous variables. The bounds testing procedure, developed by Pesa ran et al. (2001), requires the estimation of the following equation, which derives the relationship between Manufacturing Sector Output (MANO) and the independent variables; Deposit Money Banks' Credits to Manufacturing Sector (DMBC), Lending Rate (LENR) and Inflation rate (INFL) as a conditional autoregressive distributed lag (ARDL):

$$\Delta MANO_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta MANO_{t-i} + \sum_{i=1}^{q_1} \alpha_{2i} \Delta DMBC_{t-i} + \sum_{i=1}^{q_2} \alpha_{3i} \Delta LENR_{t-i} + \sum_{i=1}^{q_3} \alpha_{4i} \Delta INFL_{t-i} + \beta_1 MANO_{t-1} + \beta_2 DMBC_{t-1} + \beta_3 LENR_{t-1} + \beta_4 INFL_{t-1} + \varepsilon_t \quad (6)$$

Where Δ is the first difference operator p, q_1, q_2, q_3 and q_4 are the lag lengths. The null hypothesis in the long-run is H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ which implies no cointegration. The computed F-statistic is compared with critical values or p-values. If the F -test statistic falls less than the lower bound signifies is no cointegration. If the F-test statistic is greater than the upper bound, it signifies cointegration. Conversely, if the F-statistic lies between both critical values, it signifies inconclusive. If a long-run relationship among the variables is established (cointegration presence), then the long-run model(s) is/are estimated using Error Correction Term (ECM) while for short-run relationship (no cointegration) ARDL model(s) is/are estimated.

Variance Decomposition Approach

Lastly, the study employed the variance decomposition approach also known as forecast error variance decomposition to assess the magnitude of the impact of each of the independent variables i.e. deposit money banks' credits to manufacturing sector, lending rate and inflation rate, in both short-run and long-run. This method is used to support the interpretation of a vector error correction model (VECM) once it has been fitted. The variance decomposition approach depicts the magnitude of projected error variance for a series (i.e. MANO in this case) accounted for by innovations from the independent variables over different time-horizons (i.e. Period 1 to 10). That is, it determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. For the VEC(p) form we have:

$$y_t = v + A_1 y_{t-1} + \cdots + A_p y_{t-p} + u_t \quad (7)$$

This can be changed to $Y_t = V + Ay_{t-1} + U_t \quad (8)$

where y_t, v and U are k-dimensional column vectors, A is kp by kp dimensional matrix and Y, V and U are kp dimensional column vectors. The mean squared error of the h-step forecast of variable j is $MSE[y_{j,t}(h)] = \sum_{i=0}^{h-1} \sum_{k=1}^{K} (e_j' \Theta_i \epsilon_k)^2 = (\sum_{i=0}^{h-1} \Phi_i \sum_u \Phi_i')_{jj}$ where e_j is the jth column of I_k and the subscript jj refers to that element of the matrix, $\Theta_i = \Phi_i P$; where P is a lower triangular matrix obtained by a Cholesky decomposition of $\sum u$ such that $\sum u = P'P$; where $\sum u$ is the covariance matrix of the errors u_t and $\Phi_i = JA^i J'$; where $J = [I_k, 0 \dots 0]$ so that J is a k by kp dimensional matrix. Therefore, the amount of forecast error variance of variable j accounted for by exogenous shocks to variable k is given by:

$$w_{jk,h};\ w_{jk,h} = \sum_{i=0}^{h-1} (e_j' \Theta_i \epsilon_k)^2 / MSE[y_{j,t}(h)] \quad (8)$$

Empirical Results

Presentation of Data

This study utilized secondary sourced data. The data comprised of time series variables which include the deposit money banks' loans and advances (credits) to manufacturing sector, lending rate, inflation rate and manufacturing sector output of Nigeria. The data are yearly time series and cover the periods of 1981 to 2022. All variables were extracted from Central Bank of Nigeria (CBN) Statistical Annual Bulletin. The analyses were carried out using Excel and EViews analysis packages. Table 1 presents the variables descriptions of the aforementioned time series data as considered in this study. Subsequently, Table 2 depicts the descriptive statistics of the four (4) variables considered. As observed from table, for the periods i.e. 1981-2022 under study, the average recorded manufacturing sector output (MANO) and deposit money banks' credit (DMBC) were 4.277billion and 793.53million respectively. The reported manufacturing sector output of the country ranged between 2.898billion and 6.684billion to yield a total accumulation of 179.621billion. Also, the deposit money banks' credit (DMBC) within these periods was found to range between 2.66million and 4.160billion to yield a total accumulation of 33.328billion.

Table 1. Variables Description

Variables	Code
1. Manufacturing Sector Output	MANO
2. Deposit Money Bank Loans and Advances (Credits)	DMBC
3. Lending Rate	LENR
4. Inflation Rate	INFL

Additionally, according to Table 2 the average records of lending rate and inflation rates over the period were 22.49% and 18.94% respectively. The observed inflation rates over the period, signpost poor and unfavorable economic management; as the country managed to survive with a high inflation rate which ranged from 5.39% to as high as 72.84%. This is economically worrisome and raises concerns on how the country intend to manage her economy growth and how manufacturing industries tend to increase productivity with double digits inflation rate.

Table 2. Descriptive Statistics of the Variables

	MANO	DMBC	LENR	INFL
Mean	4276.681	793.525	22.493	18.948
Median	3585.020	220.180	22.462	12.945
Maximum	6684.220	4160.300	36.090	72.840
Minimum	2898.470	2.660	10.000	5.390
Std. Dev.	1345.052	1130.105	6.096	16.455
Sum	179620.600	33328.030	-	-
Observations	42	42	42	42

Trend Analysis of Manufacturing Sector Output, Deposit Money Banks' Credits, Lending Rate and Inflation Rate of the Country

Fig 1, Fig 2, Fig 3 and Fig 4 distinctly present the time series plots as well as trend tests of Manufacturing Sector Output, Deposit Money Banks' Credits, Lending Rate and Inflation Rate respectively. To begin with, the trends of the time series plots were tested for any significant trend change using the Mann-Kendall approach. As observed in the figures, the trend tests' results depict p-values less than 0.05 significant level suggesting the rejection of null hypothesis (i.e. no significant monotonic increasing or decreasing trend) for all the series in favour of their respective alternative hypothesis. According to trend tests' result of all the time series plots of Manufacturing Sector Output, Deposit Money Banks' Credits, Lending Rate and Inflation Rate comprised of significant trend changes (i.e. monotonic increasing). Specifically, the results depict significant increasing for the variables (see Fig 1 to Fig 4).

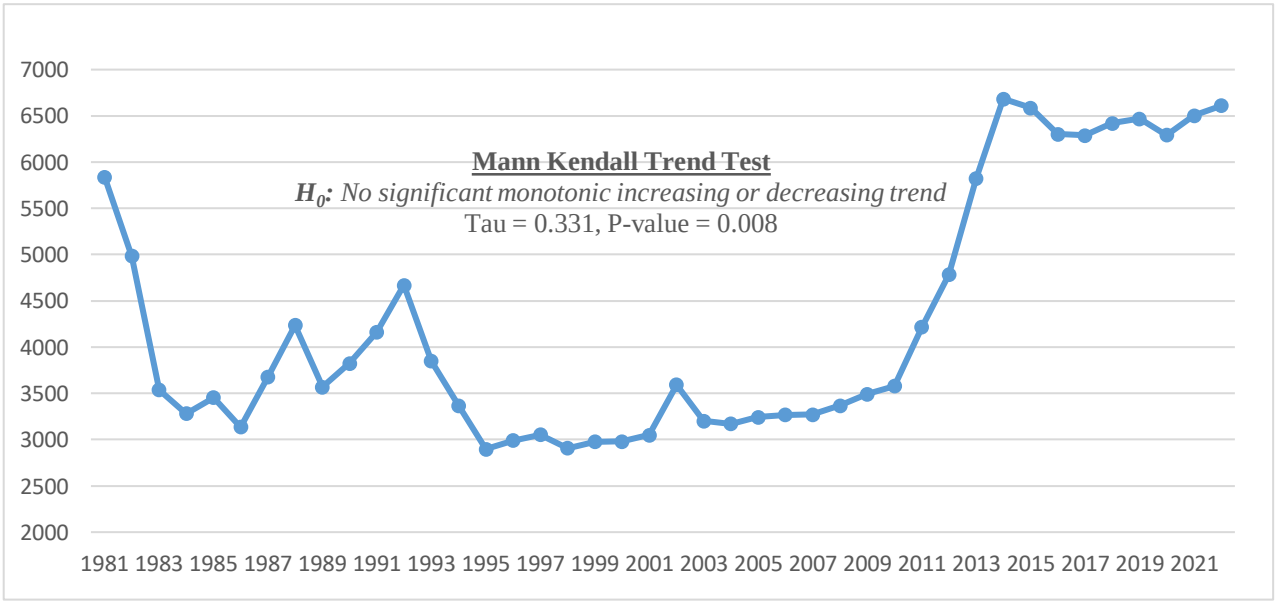

Fig 1. Time Series Plot of the Nigeria Manufacturing Sector Output (US$Million)

Furthermore, as observed in Fig 1 the Manufacturing Sector Output of the country declined abruptly from 5.839billion to 3.138billion between the year 1982 and 1986. However, the output was observed to increase relatively to yield output as high as 4.668billion between the year 1987 and 1992. Then again, the output dropped significantly as low as 2.898billion between the year 1993 and 1995. Remarkably, the Manufacturing Sector Output significantly and relatively rose as high as 6.684billion between the year 1996 and 2022. Thus, it can be inferred that the country manufacturing sector outputs has been relatively increasing since the return of democratic government.

Moreover, as observed in Fig 2 the deposit money banks' credits to manufacturing sector in Nigeria was relatively as low as 2.66million and constant between the year 1981 and 1999. Remarkably, the credits to manufacturing sectors significantly and steadily rose to as high as 4.160billion between the year 2000 and 2022. Therefore, this implies that deposit money banks' credits to manufacturing sector in Nigeria has been steadily increasing since the country return to democratic system of government.

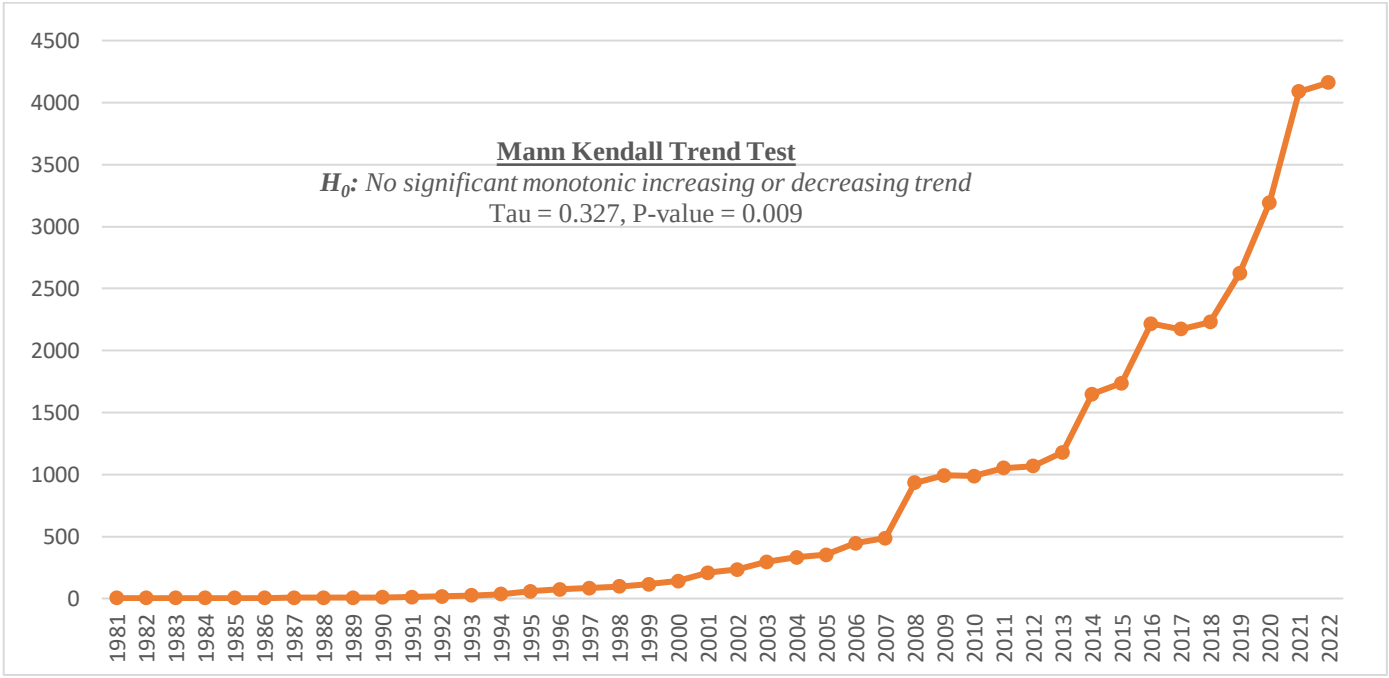

Fig 2. Time Series Plot of the Deposit Money Banks' Credits to Manufacturing Sector (Million)

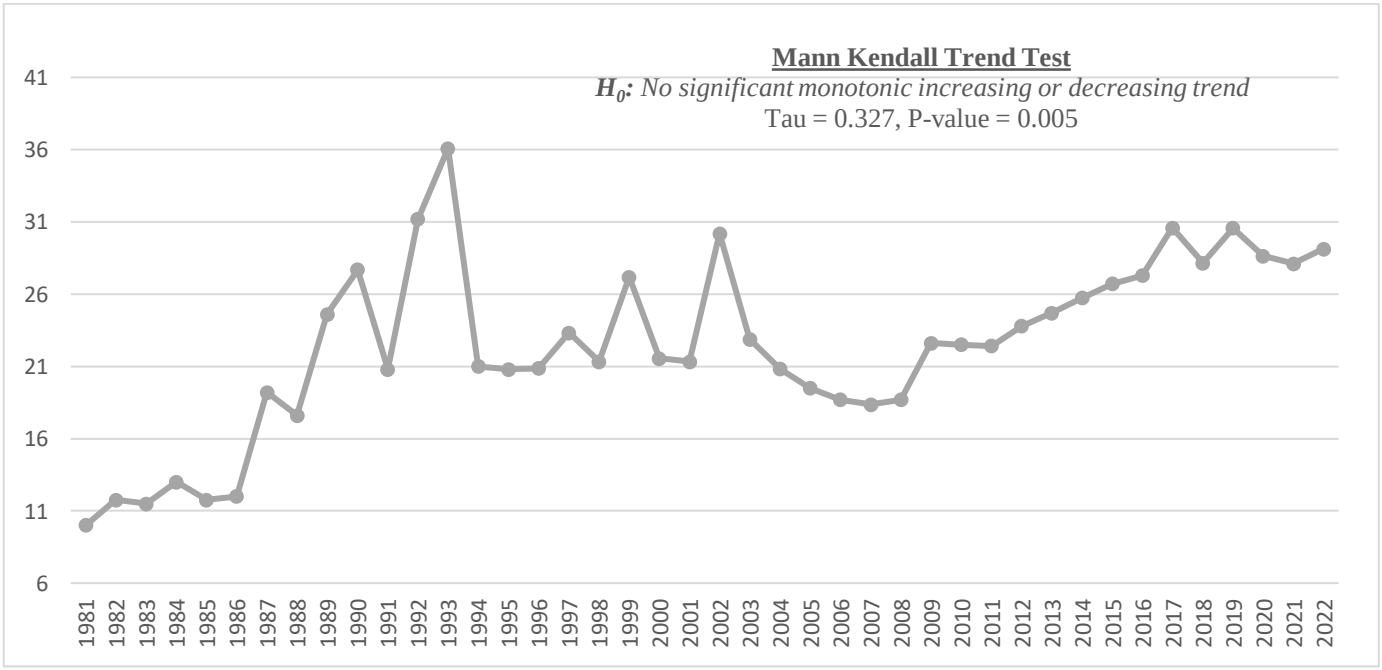

Fig 3. Time Series Plot of the Nigeria Lending Rate

In addition, Fig 3 presents the time series plot of Nigeria lending rate between the year 1981 and 2022. As observed, the lending rate rose as high as 36.09% between the year 1981 and 1993. Afterwards, it was observed to dropped as low as 20.79% between the year 1994 and 2001, it then rose significantly to 3019% in year 2002 to dropped again to as low as 18.70% between the year 2003 and 2008. The lending rate was then observed to increase significantly to as high as 20.6% between 2009 and 2022. Thus, the time series plot signposts an increasing lending rate over the years (particularly since 2008). Also, Fig 4 depicts the time series plot of the country inflation rate for the period under examination. According to the figure, the country inflation rate was observed to be fluctuating as high as 23.21% and as low as 5.72% between the year 1981 and 1987. Afterwards, the country inflation rate witnessed its high regime which was between the year 1988 and 1996, with highest rate of 72.84%. Then the inflation dropped significantly to 8.53% in the year 1997. As observed in the figure, the inflation rate has been relatively increasing since 2001. Similar to the inflation rate descriptive statistics, the time series plot signpost economic concerns on how the manufacturing industries tend to increase productivity with double digits inflation rate.

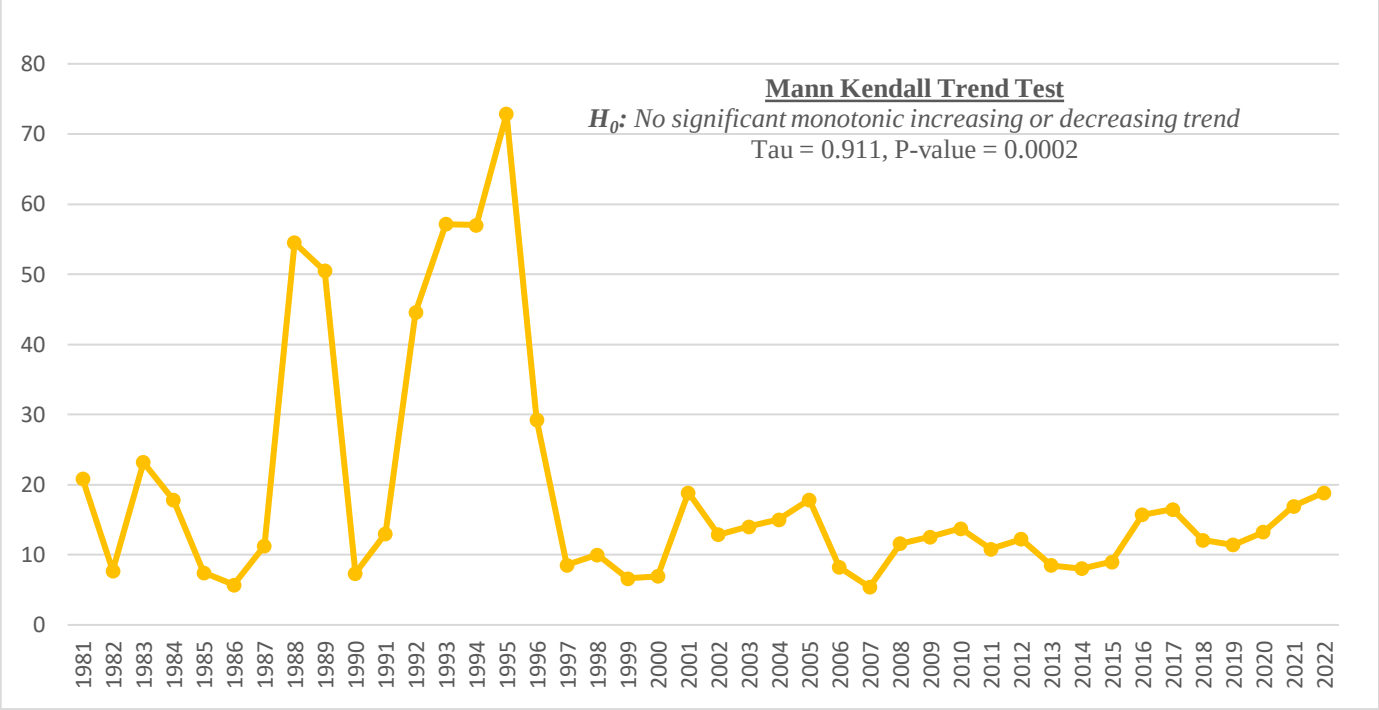

Fig 4. Time Series Plot of the Nigeria Inflation Rate

Assessment of the Causal Relationship between the Manufacturing Sector Output, Deposit Money Banks' Credits, Lending Rate and Inflation Rate of the Country

Subsequently, this study adopted Ordinary Least Square (OLS) as a conventional technique to obtain the numerical estimates of the coefficients of the relationship existing between the variables using manufacturing sector output as proxy dependent variable and deposit money banks' credits, lending rate and inflation rate of the country as independent variables. The OLS method is chosen because it possesses some optimal properties; its computational procedure is fairly simple and it is also an essential component of most other estimation techniques. The regression estimation results (Table 3) shows that the relationship between the dependent MANO and independent variable DMBL, LENR, INFL and intercept C. The results returned DMBL and the intercept C as the only significant causative variables influencing the MANO. However, the regression model estimation returned to be spurious and cannot be reliable as a result of an unrealistic high value of R-Squared (i.e. 0.9289). This result infers existence of relationship between the independent variables (i.e. presence of multicollinearity or cointegration). Therefore, the regression model's residuals were tested for cointegration using Engle-Granger residual approach (see Table 4). Table 4 presents the regression model residuals' test results for presence of cointegration. The results depict an insignificant p-value (i.e. 0.894>0.05) therefore, the null hypothesis cannot be rejected for unit root present (i.e. cointegration). Hence, the results affirm the presence of causal (cointegration) relationship among the variables.

Consequent to the established cointegration among the variables, it is therefore imperative to understand the paired variables that significantly exhibit a causal relationship; thus Table 5 presents the pairwise Granger Causality test results. According to the pairwise Granger Causality test results, it is observed that the DMBC did significantly granger cause (i.e. cause output changes in) the MANO (at p-value 0.0053<0.05). As well as the MANO did significantly cause changes in the DMBC (at p-value 0.048<0.05).

Table 3. Regression Model Estimation

Dependent Variable: MANO				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DMBL	0.941809	0.144414	6.521582	0.0000*
LENR	2.624910	26.30845	0.099774	0.9210
INFL	1.696029	8.639723	0.196306	0.8454
C	3438.156	539.0065	6.378691	0.0000*
R-squared	0.928938	Mean dependent var		4276.681
Adjusted R-squared	0.899644	S.D. dependent var		1345.052
S.E. of regression	851.0643	Akaike info criterion		16.42125
Sum squared resid	27523799	Schwarz criterion		16.58674
Log likelihood	-340.8462	Hannan-Quinn criter.		16.48190
F-statistic	21.46958	Durbin-Watson stat		0.348338
Prob(F-statistic)	0.000000			

Note: * denotes significant at 5%

Source: EViews Outputs

Table 4. Engle Granger Residual Cointegration Test

Test Statistic	**Value**	**Probability (p-value)**
ADF Test Statistic	-3.1301	0.8943
Engle-Granger Critical Value (5% level)	-4.13	—

H_0: Residual has Unit Root vs. H_1: Residual has no Unit Root. Source: EViews Output

Table 5. Pairwise Granger Causality Tests

Null Hypothesis	**Obs**	**F-Statistic**	**p-value**	**Decision**
DMBC does not Granger Cause MANO	32	5.23745	0.0053*	Reject Null (Significant)
MANO does not Granger Cause DMBC	32	2.65593	0.0428*	Reject Null (Significant)
LENR does not Granger Cause MANO	32	5.37689	0.0071*	Reject Null (Significant)

MANO does not Granger Cause LENR	32	2.76794	0.0549	Fail to Reject Null (Not Significant)
INFL does not Granger Cause MANO	32	2.75486	0.0474*	Reject Null (Significant)
MANO does not Granger Cause INFL	32	2.59424	0.0667	Fail to Reject Null (Not Significant)
LENR does not Granger Cause DMBC	32	0.25565	0.9799	Fail to Reject Null (Not Significant)
DMBC does not Granger Cause LENR	32	0.48155	0.87	Fail to Reject Null (Not Significant)
INFL does not Granger Cause DMBC	32	0.1292	0.9985	Fail to Reject Null (Not Significant)
DMBC does not Granger Cause INFL	32	0.35496	0.9431	Fail to Reject Null (Not Significant)
INFL does not Granger Cause LENR	32	5.62432	0.0043*	Reject Null (Significant)
LENR does not Granger Cause INFL	32	2.99634	0.0429*	Reject Null (Significant)

Note: denotes significance at5%

Source: EViews outputs

In addition, thresultsshow that the LENR (at p-value 0.0071<0.05) and INFL (at p-value 0.0474<0.05) did significantly cause changes in the MANO. Also, the table shows that the LENR did significantly cause changes in the INFL (at p-value 0.0429<0.05) as well as INFL did significantly cause changes in the LENR (at p-value 0.0043<0.05). Therefore, while lending rate and inflation rate were found to significantly cause changes in the manufacturing sector output, the pairwise Granger Causality test results revealed significant two-dimensional causal relationships (i.e. both variables influencing each other) between the manufacturing sector output and deposit money banks' credit to manufacturing sector. Similarly, the lending rate and inflation rate significantly exhibit two-dimensional causal relationships. The results from Engle-Granger residual approach and Pairwise Granger Causality Tests signpost a cointegration modelling approach to further explain the dynamics relationship (i.e. short or/and long run relationship) between the variables.

Assessment of Short-run and/or Long-run between the Manufacturing Sector Output, Deposit Money Banks' Credits, Lending Rate and Inflation Rate of the Country

Prior to the assessment of the short and long run relationship between the manufacturing sector output, deposit money banks' credits, lending rate and inflation rate of the country, the study assessed the level of stationarity of the series in order to ascertain the integration order (stationarity level) of each of the time series variables. Table 6 presents the results of the stationarity tests using the Augmented Dickey Fuller (DF) approach. According to the results (i.e. integration order), three (3) of the series (variables) namely MANO, DMBC and LENR were found stationary at first differenced (I = 1) and other one (i.e. INFL) established stationarity at level (I = 0). Hence, this implies that a short-run model such as ARDL model or long-run model such as VECM is appropriate to capture the dynamics relationship between the variables since they achieved stationarity at level (I = 0) and first difference (I = 1).

Table 6. Stationarity Test (ADF)

Variables	k̂	Integration Order (I)	P-Value
MANO	0	1	0.0033
DMBC	4	1	0.0000
LENR	1	1	0.0000
INFL	0	0	0.0121

Note:k̂ is the AIC lag term is used to select the optimal lag, to make the residuals white noise

Table 7. Short-run and Long-run Relationship Assessment (ARDL Bound Test)

S/N	Dependent Variable	Model Selection	F-Statistic	Long-run Relationship	Decision
1	MANO	ARDL (2, 0, 0, 0)	5.2304*	Yes	Estimate ECM (long-run model)
2	DMBL	ARDL (4, 0, 0, 0)	5.6265*	Yes	Estimate ECM (long-run model)
3	LENR	ARDL (2, 0, 0, 4)	3.3357	No	Estimate ARDL (short-run model)
4	INFL	ARDL(3, 4, 0, 3)	0.9636	No	Estimate ARDL (short-run model)

Note: H_0:- No significant long relationship between the variable

* Indicates significant at 5% level (i.e. F-Stat >3.23 or 4.35 critical value)

Consequently, the short-run and long-run relationship between manufacturing sector output, deposit money banks' credits, lending rate and inflation rate of the country were assessed, Table 7 presents the results. The results reveal that the null hypothesis of no significant long-run relationship can be rejected for the following variables manufacturing sector output (MANO) and deposit money banks' credits (DMBC) when used as dependent variable. This implies that MANO and DMBC as dependent variable did significantly exhibit long-run relationship with their respective corresponding exogenous variables. Based on the Bound Test results which returned significant long-run relationship for the system when manufacturing sector output (MANO) and deposit money banks' credits (DMBC) are used as dependent variable, this study therefore considered the Vector Error Correction Model (VECM) with center focus on the manufacturing sector output variable (MANO) in order to estimate the impact of respective exogenous variables in the system.

Furthermore, the rest part of this section discusses the long-run relationship between manufacturing sector output, deposit money banks' credits, lending rate and inflation rate with manufacturing sector output as center focus. Table 8 presents the long-run cointegrating model. The results reaffirm significant long-run relationship between dependent variable MANO and the independent variables; BMBC, LENR and INFL. According to the results, in the estimated long-run association, DMBC was found to have significant positive impact on the MANO while the LENR and INFL were found to have significant negative impact on the MANO. As observed in the long-run cointegration of the variables, a unit increase in the DMBC would significantly cause a rise of about 6.89 units in the MANO. On the other hand, a unit increase in the LENR and INFL would result into significant shrinkage of about 520.54 and 92.16 units in the MANO respectively. The long-run cointegrating model is presented as follows:

$$\mathrm{ECT}_{t-1} = \mathrm{MANO}_{t-1} - 6.8865\mathrm{DMBC}_{t-1} + 520.5435\mathrm{LENR}_{t-1} + 92.1630\mathrm{INFL}_{t-1} - 9170.659 \quad \textbf{(9)}$$

Therefore, presenting the manufacturing sector output (MANO) as dependent variable in equation (9), we have;

$$MANO_{t-1} = 9170.659 + 6.8865DMBC_{t-1} - 520.5435LENR_{t-1} - 92.1630INFL_{t-1} \quad \textbf{(10)}$$

Table 8. Long-run Cointegrating Model

Dependent Variable: MANO (-1)	Coefficient	Standard error	t-Statistic	Decision
DMBC (-1)	-6.88651	1.31719	-5.22819*	Significant
LENR (-1)	520.5435	154.635	3.36628*	Significant
INFL (-1)	92.16295	56.2817	2.74933*	Significant
C (Constant)	-9170.66	-	-	-

Note: Standard errors in () & t-statistics in [ ]; * denotes significant at 5% (i.e. t-stat>1.95)

Table 9. VEC Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h		
Sample: 1981 2022		
Included observations: 37		
Lags	LM-Stat	Prob
1	17.82792	0.3341
2	12.14427	0.7340
3	16.52716	0.4168
4	5.397542	0.9934
5	25.11322	0.0679
6	19.37448	0.2497
7	7.846694	0.9533
8	8.191503	0.9430
9	11.23426	0.7948
10	5.246433	0.9944
11	24.00016	0.0895
12	14.26742	0.5788

Source: EViews Outputs

Prior to the discourse of VECM granger causality analysis of the short-run and long-run cointegration, the model residuals were diagnosed in to ensure the adequacy of the specification of the model. Table 9 and Table 10 present the VEC Residual Serial Correlation LM test and Normality test respectively. As displayed in Table 9, all the computed residual serial Lagrange Multiplier (LM) test for the lags is statistically insignificant at conventional significance level i.e. 0.05, which suggest that the disturbances are serially uncorrelated. Also, as observed in Table 10 the joint p-value for Jarque-Bera normality test is statistically insignificant at conventional significance level (i.e. 0.05), which suggest that the VECM residuals are normally distributed. Hence, the VECM is adequately specified and appropriately estimated.

Table 10. VEC Residual Normality Tests

Null Hypothesis: residuals are multivariate normal			
Component	**Jarque-Bera**	**df**	**Prob.**
1	0.824357	2	0.6622
2	1.116830	2	0.5721
3	0.071559	2	0.9649
4	0.562114	2	0.7550
Joint	2.574861	8	0.9581

Source: EViews Outputs

Moreover, Table 11 presents summary of VECM granger causality analysis of the short-run and long-run cointegration. The path of granger causality can be divided into short run and long run causality. The results show that the DMBC significantly and positively impacted the MANO both in the short-run and long-run, while INFL significantly and negatively impacted the MANO both in the short-run and long-run. Similarly, according to the results the MANO significantly and negatively impacted the INFL both in short-run and long-run. Thus, we can approximately say that bidirectional causality exists between MANO and INFL while a unidirectional causality exists between deposit money banks' credit and manufacturing sector output. In addition, as observed in the table LENR did significantly and positively impacted the DMBC both in the short-run and long-run. This implies a unidirectional causality exists between lending rate (LENR) and deposit money banks' credit to manufacturing sector (DMBC). Also, the LENR significantly and positively impacted the INFL in both short-run and long-run. And INFL was found to significantly and positively impact itself both in short-run and long-run. Thus, this also implies a unidirectional causality exists between lending rate and inflation rate.

Table 11. Summary of VECM Granger Causality Analysis of Short-run and Long-run Cointegration

Dependent Variable	C	DMANO (-1)	DBMBC (-1)	DLENR (-2)	DINFL (-1)	ECT (-1)
DMANO	203.0756 (89.1325) [2.2784] *	0.1911 (0.1523) [1.2547]	0.8227 (0.4942) [2.6647] *	-6.5698 (15.7455) [-0.4173]	-10.1984 (4.5625) [-2.2353] *	0.0522 (0.0246) [2.1182] *
DDMBC	108.3046 (46.2169) [2.3434] *	-0.0006 (0.0790) [-0.0072]	-0.0726 (0.2563) [-0.2832]	2.2466 (8.1643) [2.2752] *	-2.4709 (2.3658) [-1.0445]	0.0213 (0.0129) [2.6696] *
DLENR	1.7385 (0.9145) [1.9011]	0.0014 (0.0016) [0.9034]	-0.0056 (0.0051) [-1.1109]	-0.2763 (0.1615) [-1.7105]	0.0588 (0.0468) [1.2563]	-0.0004 (0.0003) [-1.6651]
DINFL	-5.7916 (2.5664) [-2.2567] *	-0.0126 (0.0044) [-2.8696] *	0.0229 (0.0142) [1.6147]	1.3860 (0.4534) [3.0572] *	0.3279 (0.1314) [2.4962] *	-0.0016 (0.0007) [-2.2330]*

Note: () Standard errors, [ ] t-statistics and * denotes significant at 5%

Among other findings it can be inferred from the aforementioned results that deposit money banks' credits and inflation rate were the variables that significantly influenced the manufacturing sector outputs. Explicitly, it

can be deduced that deposit money banks' credits significantly and positively influenced the manufacturing sector output while inflation rate significantly and negatively influenced the manufacturing sector output both in short and long run. Also, lending rate significantly and positively influenced the deposit money banks' credit to manufacturing sector and inflation rate of the country both in short-run and long-run. Conversely, the manufacturing sector output was found to significantly negatively influence the inflation rate of the country in short and long run.

Table 12. Forecast Variance Decomposition of the Manufacturing Sector Output

Period	S.E.	MANO	DMBC	LENR	INFL
1	375.9118	100.0000	0.000000	0.000000	0.000000
2	574.9763	95.13431	2.172395	1.737117	0.956178
3	743.8505	87.74989	4.067143	6.549828	1.633139
4	863.9090	83.12442	3.286986	12.30686	1.281725
5	966.7424	78.89134	3.288750	16.62319	1.196719
6	1068.286	73.95473	6.253911	18.46708	1.324276
7	1178.810	67.77008	11.25671	19.58952	1.383694
8	1308.388	60.64839	16.92094	21.01906	1.411601
9	1459.677	53.07332	23.02329	22.40670	1.496689
10	1634.924	45.45885	29.57881	23.27087	1.691476

Consequently, the forecast variance decomposition of the manufacturing sector output was assessed using Variance Decomposition Approach (VDA). VDA is an improved approach of Granger causality. The analysis depicts the magnitude of projected error variance for the MANO series accounted for by innovations from the DMBC, LENR and INFL over different time-horizons i.e. period 1 to 10. Table 12 presented the VDA results. The period (1) indicates the short run while down to period (10) it connotes long run. According to the forecast variance decomposition results of the manufacturing sector output, the DMBC depicts a magnitude as high as 4.07% of the total variation in MANO within the short-run periods (1-4). The magnitude of the DMBC showed to drop incoherently in mid period-5 (i.e.3.29%). Afterward, the DMBC tend increase progressively to as high as 29.58% down the long-run periods (i.e. 6-10). Also, as observed the LENR returned to forecast a highest magnitude of about 12.31% of the total variation in MANO within the short-run periods (1-4). The magnitude of the LENR also showed to progressively increase down the long-run periods (6-10). However, the VDA results show INFL to account for the lowest and variably constant magnitude of the total variation in MANO within both periods (short and long run).

DISCUSSION OF FINDINGS

This study found significant increasing trend in the time series plots of manufacturing sector output, deposit money banks' credit to manufacturing sector, lending rate and inflation rate of Nigeria. Explicitly, the observed reasonably increasing trend in manufacturing sector output and deposit money banks' credit to the sector over the period signposts the nation economic growth in terms productivity. However, the increasing productivity in the manufacturing sector became more worrisome with the observed increasing in the lending rate and inflation rate trend. This finding is similar to Anyaegbuna (2017) who found inflation rate to be challenging for the manufacturing industries productivity. Thus, the imperative to assess the magnitude of impact of these variables on the threatened increasing trend of manufacturing sector output.

Moreover, empirical findings from the Engle-Granger residual approach results significantly affirmed the presence of cointegration (causal relationship) between the variables. More specifically, among other findings the Granger Causality results established lending rate and inflation rate to significantly cause changes in the

manufacturing sector output. This is similar to studies like Anyaegbuna (2017), Oluwafemi (2014), Modebe and Ezeaku (2016), Achi (2020) and Falade (2021) who found inflation rate and exchange rate to influence the manufacturing sector outputs. Also, the results revealed significant two-dimensional causal relationships (i.e. both variables influencing each other) between the manufacturing sector output and deposit money banks' credit to manufacturing sector. Similarly, the lending rate and inflation rate significantly exhibit two-dimensional causal relationships. Thus, from the aforementioned this study uniquely found deposit money banks' credit to manufacturing sector, lending rate and inflation rate significantly cointegrated with the country manufacturing sector output.

Furthermore, following the established causal relationship between the manufacturing sector output, deposit money banks' credit to manufacturing sector, lending rate and inflation rate, the empirical findings from the ARDL analysis distinctively and significantly established long-run causal relationship between the variables with manufacturing sector output as dependent variable. Explicitly, the VECM results found the deposit money banks' credit to manufacturing sector significantly and positively impact the manufacturing sector output both in the short-run and long-run. The significant positive increasing impact of the deposit money banks' credit to manufacturing sector could be interconnected to the significant positive impact of lending rate on deposit money banks' credit. Conversely, the inflation rate was found to significantly and negatively impact the manufacturing sector output both in short-run and long-run. Similarly, the significant negative impact of inflation rate on manufacturing sector output could be also be connected to the significant positive impact of lending rate on inflation rate. Variably, it can be inferred that the Nigeria lending rate plays significant role in contributing to deposit money banks' credit to manufacturing sector and inflation which are significant contributing factor of manufacturing sector output.

As a final point, follow-up to abovementioned findings the forecast variance decomposition of the manufacturing sector output uniquely revealed that while inflation rate was project to account for the lowest and variably constant magnitude of the manufacturing sector output total variation within the short and long run periods, the lending rate was projected to account for the highest magnitude (when compare to other variables) of about 12.31% of the total variation within the short-run periods (1-4) and on the other hand the deposit money banks' credit was revealed to account for a highest magnitude (when compare to other variables) of about 29.58% down the long-run periods (i.e. 6-10). Lucidly, this finding infers lending rate plays significant role to influence the productivity of the manufacturing sector. It therefore calls for urgent attentions from the government and policymakers to address the rising lending rate as well as developing and implementing apt fiscal policies as relate to decline in inflation rate in order to make the manufacturing sector more attractive.

CONCLUSION AND RECOMMENDATIONS

Following the above discussion of empirical findings, this study concludes significant increasing trend in the time series plots of manufacturing sector output, deposit money banks' credit to manufacturing sector, lending rate and inflation rate of Nigeria. Additionally, this study reasonably concludes national economic growth in terms productivity for the increasing trend observed in manufacturing sector output and deposit money banks' credit. On the other hand, the study concludes a worrisome situation for the manufacturing sector following the observed increasing for the lending rate and inflation rate. Moreover, based on the empirical findings from Granger Causality and ARDL this study concludes that deposit money banks' credit to manufacturing sector, lending rate and inflation rate significantly cointegrate with the country manufacturing sector output. Explicitly from the VECM findings, this study concludes that deposit money banks' credit to manufacturing sector significantly and positively impacts the manufacturing sector output both in the short-run and long-run, which could be interconnected to the significant positive impact of lending rate on deposit money banks' credit. Similarly this study drawn conclusion that the inflation rate significantly and negatively impacts the manufacturing sector output both in short-run and long-run, which also could be connected to the significant positive impact of lending rate on inflation rate. This study posits that Nigeria lending rate plays significant role in contributing to deposit money banks' credit to manufacturing sector and inflation which are significant contributing factor of manufacturing sector output. This study therefore calls for urgent attentions from the government and policymakers to address the rising lending rate as well as developing and implementing apt fiscal policies as relate to decline in inflation rate in order to make the manufacturing sector more attractive.

Recommendations

Based on the foregoing, the following are recommended:

1. An improved policy measure by Central Bank of Nigeria towards the control of inflation and reduce the inflationary pressure on manufacturing firms' profitability and ability to meet contractual obligations with the DMBs as and when due;
2. The fiscal authority i.e. CBN should urgently increase efforts towards increasing the quantum of intervention funds targeted exclusively to the manufacturing sector thereby boosting the sector access to credit, enhancing its productivity and boosting manufacturing output.
3. Government and policymakers (legislators and CBN) should address the rising lending rate in real time by developing and implementing apt fiscal policies to regulate the lending rate in order to make the manufacturing sector more attractive for productivity and lessen the double figure inflation rate of the country.

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