Academy Journal of Multidisciplinary Doctoral Research [AJMDR]
Volume 2, Issue 2, 2024 ISSN: 2992-4669 || eISSN: 1116-3321

Government Capital Expenditure and Manufacturing Output in Nigeria: A Vector Error Correction Model Approach.

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Received: 14-06-24
Accepted: 12-08-24
Published: 25-12-24

Abstract

This study investigates the effect of Government Capital Expenditure in Nigeria from 1986-2023 utilizing time series data. The study adopted the Vector Error Correction technique for the estimation and analyses of results. The study employed Augmented Dickey Fuller test, Johanson Co-integration test, Vector Error Correction Model (VECM) and diagnostic test. The unit root test depicts that the variables under study (Government Capital Expenditure, inflation, Bank Credit and Manufacturing sector output) are stationary at first difference. The Johanson co-integration test reveals that the variables under study have long-run equilibrium relationship. Also, the long-run co-integrating vector result depicts that Government capital expenditure has negative effect on manufacturing output while Inflation and bank credit on deposit money banks have negative effect on manufacturing output. The results depict that the variables understudy have significant effect on the manufacturing output in Nigeria. Based on the findings, the study recommends that; government should invest in infrastructure like electricity plants, bridges, and roads to boost manufacturing output, attract investors, and improve living standards. Reducing inflation rates can also boost the sectors output and GDP.

Keywords: Key words: Government Capital Expenditure, Manufacturing Output and Vector Error Correction Model

1.0 Introduction

A nation's manufacturing sector is vital to its growth and development. The industry plays a significant part in industrialization and the advancement of society. Any nation's progress depends heavily on the manufacturing sector, which creates jobs, advances technology, and promotes general economic growth. Even though it has a significant impact on economic activity, it has encountered a number of difficulties that could affect both its output and the overall economy.

Spending by the government is a vital instrument for economic growth. It might be seen as the value of the goods and services provided by the state. Jumare (2016) referenced Mordi (2010) as saying that government spending trends can be roughly divided into two categories: capital expenditure and recurrent expenditure.

Government investment on infrastructure and other services that are expected to pay for itself eventually is referred to as government capital expenditure, also known as fixed capital formation. This includes support for sewage systems, roads, trains, airports, communication, water collection and distribution, and research (military, genetics, and space). This is also known as future investment. Money is set aside for infrastructure development since it takes the country's long-term survival into consideration (Musa and Alex, 2020). In Nigeria, capital expenditures by the government are necessary for covering in infrastructural gaps and fostering economic growth, especially in the manufacturing sector. Nigeria's manufacturing industry contributes significantly to employment generation and economic diversification. However, it has frequently encountered difficulties, such as poor infrastructure, expensive production costs, and uncertain regulations, which can impact its growth

and competitiveness. Capital spending by the government may have a favorable impact on the manufacturing sector. Investments in transportation, power, and road infrastructure can lower production costs and improve the business environment overall. Also, manufacturing activities can be driven by policies. As noted by Ku et al. (2010), Nigeria's manufacturing sector has difficulties that limit competitiveness and impede expansion, such as poor infrastructure, high energy costs, and production expenses. Every year, production costs rise by 30%, and small businesses have difficulty obtaining adequate funding. Investors find the macroeconomic climate unappealing due to high interest rates, restricted access to credit facilities, and a lack of tax benefits. To boost exports, the business finds it difficult to attract investors.

In 2023, Procter & Gamble, a prominent player in the diaper industry, shut down its $300 million facility located in Agbara, Lagos. The issue is made worse by the decline in domestic product demand and the depreciation of the national currency. Due to high interest rates and a shortage of liquidity, the manufacturing sector finds it difficult to attract investors in order to boost exports. The manufacturing sector's share of the GDP was N6.421 trillion in 2018; N6.470 trillion in 2019; N6.292 trillion in 2020; N6.502 trillion in 2021; and N6.661 trillion in 2022, as reported by the National Bureau of Statistics (2023). These figures represent 9.20 percent, 9.06 percent, 8.99 percent, 8.98 percent, and 8.92 percent, respectively.

To buttress, the relationship between government capital expenditure and manufacturing output is still ambiguous. In light of this, the study uses the Vector Error Correction Model Approach to examine the examine between government capital expenditure and industry production in Nigeria. The stationarity test of the variables under consideration indicates that they are integrated at first difference, and the cointegration test shows that the variables are co-integrated over the long term, which led to the selection of the VECM model. The VECM is therefore the ideal model for the research. In order to achieve the objective of the study and answer the research questions, the following hypotheses are expressed in the null form:

i. H_{o1}: There is no long run equilibrium relationship among government capital expenditure, inflation and manufacturing sector output.

ii. H_{o2}: There is no short and long run effect of government capital expenditure, inflation, bank credit on manufacturing sector output in Nigeria.

Conceptual Review

It is relevant to explain the concepts of the variables used in the study for better understanding of the direction of the study. These variables are government capital expenditure, manufacturing output, inflation and bank credit.

Government Capital Expenditure: According to Agbonkhese and Asekome (2014), the money that a government uses to purchase, maintain, or upgrade its long-term assets—such as buildings, machinery, land, and non-physical assets—is referred to as government capital expenditure. These costs, which are usually spread out across a year, are intended to develop or improve assets that would eventually improve public services, spur economic growth, and benefit society.

Manufacturing Output: The term may refer to a wide range of activities from handicraft to high tech. However, most people use it when talking about industrial production. Specifically, when the manufacturer transforms raw materials into finished goods on a large scale, it is called manufacturing. According to Wang (2016) Manufacturing is the usage of physical and chemical processes by altering the material geometry properties and appearance, in order to make components or products.

Inflation: Jhingan (2012) explains refers to the inflation that arises from an excess of aggregate demand as demand pull inflation. While structural inflation emerges from many restrictions like inefficient manufacturing, marketing, and distribution networks in the productive sectors of the economy, cost push inflation is caused by wage increases enforced by unions and profit increases by employers.

Bank Credit: Bank credit stands for credit extended by banks to borrowers (Audu, 2020). The

term is frequently use in plural to mean all advances made to borrowing customers (Phillips, 1931). More so, bank credit is defined as the borrowing capacity provided to an individual by the banking system, in the form of credit or a loan (Ndolovu, 2013).

Theoretical Underpinning

Based on the complex nature of the modern manufacturing sector, the Managerial Theory of Firm developed by Bumole (1967) in his book Business Behavior, Value, and Growth and also used by Sangosanya (2011), emphasizes that a firm's decisions to grow or not depend on the level of fiscal policy because the firm grows through government expenditure on industrialization. The theory holds that the reason why managers are hired is for revenue maximization and not for profit maximization. The theory further contends that in order for the economy to grow faster through industrialization, the nation must increase its public expenditure in order to facilitate the developmental processes of their economies. This is the theory of which this firm's decisions whether to grow or not depends on the level of fiscal policy because the firm's grow through government expenditure.

Empirical Review

Numerous studies have looked into the connection or influence of various macroeconomic factors on Nigeria's manufacturing output. Nonetheless, very little research has been done on the relationship between Nigerian manufacturing output and government capital expenditure. For example, Efanga et al. (2022) used the Autoregressive Distributed Lag (ARDL) approach for estimate to study the effect of commercial banks' loans to the industrial sector on Nigeria's economic growth. One of the most important conclusions is that there is a substantial correlation between economic growth and the credit provided by Nigeria's commercial banks. The investigation also showed that, in contrast to apriori predictions, the majority of the models' primary explanatory factors for credit in commercial banks were statistically insignificant. The study consequently comes to the conclusion that the effect of commercial banks' credit to the manufacturing sector of the economy is mixed and largely insignificant in Nigeria.

Falade and Olagbaju (2015) looked into the relationship between government expenditure and the production of Nigeria's manufacturing sector. Time series data from 1970 to 2013 were used in the study using the Vector Error Correction Model (VECM). At the five percent significance level, the Johansen cointegration technique verifies the existence of a single cointegrating link. Furthermore, estimates of error correction showed that government capital expenditures and manufacturing sector output in Nigeria are positively correlated, whereas recurrent expenditures have a negative impact on the latter. However, because the VAR model makes minimal use of economic theory, estimating for complex circumstances can be challenging.

Nwanne (2015) investigated the effect of government capital expenditure on the manufacturing sector output in Nigeria. The result of the co-integration test indicates long run relationship between dependent and independent variables. It also reveals that capital expenditure on road infrastructure and telecommunication affect the manufacturing sector output in Nigeria significantly while government capital expenditure on power has insignificant effect on manufacturing sector in Nigeria.

However, Chikelu and Okoro (2016) examined whether the low manufacturing sector's growth in Nigeria is as a result of the poor allocation to capital expenditure, also whether there is any causal relationship between capital expenditure and manufacturing sector's growth. The study employed VECM. Granger causality test is employed to determine whether there is any causal relationship between capital expenditure and manufacturing sector's growth. The study finds that capital expenditure has significant impact on manufacturing sector's growth. It also finds that capital expenditure Granger causes manufacturing sector's growth in Nigeria. However, granger causality technique cannot reveal directed causal influence from time series to the other one among three time series. More so, using VAR model, it can be difficult to estimate for complex situations, since they use little economic theory.

In (2023), Nwokorobia and Okwonkwo examined the relationship between the federal government capital expenditure and industrial production output in Nigeria: 1981-2022. The models' parameters

were estimated using ordinary least square method. The results revealed that Government Capital Expenditure had significant positive relationship with manufacturing Sector Output in Nigeria. However, OLS technique is responsive to outliers

In (2018) Gboyinde, identified the determinants of manufacturing output and the direction of the impacts of such variables on output. The cointegration test was also carried out to know the long-run relationship among the variables. The study estimated the short and long run coefficients of the ARDL and tested for the effect of the error correction mechanism that indicates the speed of adjustment to the long-run situation. The findings, revealed that, in the short-run, employment in the manufacturing subsector and exchange rate depreciation have a negative impact on the output while trade openness and government capital expenditure have positive effects on manufacturing output. The effects of gross capital formation and inflation rate are not significant. In the long-run, the effect of government capital expenditure, gross capital formation and employment in the manufacturing subsector are positive and significant while the effects of exchange rate depreciation and trade openness are negative. The effect of only inflation is not significant. Notwithstanding, the distributed lag models can be problematic when the lag length is long, especially in small samples

Eze (2014) examined the impact of fiscal policy on the manufacturing sector output in Nigeria. The study employed VECM technique of analyses. The results of the study indicate that government expenditure significantly affects manufacturing sector output and there is a long-run relationship between fiscal policy and manufacturing sector output. However, VAR models can be difficult to estimate for complex situations, since they use little economic theory.

Njoku et al (2014) investigated the relationship between Nigeria's capital expenditure and the growth of the manufacturing sector from 1971-2012. The study employed ordinary least square method to show the relationship between capital expenditure and manufacturing output. The results suggest that there is a positive relation between rate of growth of GDP, capital expenditure, money supply, openness of the economy, recurrent expenditure and manufacturing output in the country. However, OLS technique is responsive to outliers.

Eze, et al (2019) investigated the impact of foreign direct investment (FDI) on manufacturing sector output growth in Nigeria for the period 1970 – 2016 using OLS and Granger causality tests analysis. The study employed OLS and VECM models for analyses. The findings revealed that there is a long run relationship between Foreign Direct Investment and manufacturing sector output growth though statistically insignificant. However, it is faulty to employ OLS and VECM models at the same time for a particular study.

Okolo et al (2018) examined the impact of capital expenditure on infrastructural development in Nigeria, utilizing time series from 1970 to 2017. The study adopted autoregressive distributed lag (ARDL) model due to the possibility of the past value of the dependent variable explaining its present value, and found that capital expenditure, construction expenditure and non-oil revenue have the potency of accentuating infrastructural development in the long-run but such is being hampered by external debt. Notwithstanding, the distributed lag models can be problematic when the lag length is long, especially in small samples.

Okonkwo et al (2023) attempted to scientifically examine the effects of government capital expenditure in its disaggregated form (administration, social and community service, economic services, transfers, and government deficit) on Nigeria's economic growth rate from 1981 to 2021 in addition to evaluating how well government expenditure performed in the years following the pandemic in 2021. Secondary data sourced from the CBN statistical bulletin, 2021, were used in the analysis. The study used the autoregressive distributed lag model. The bounds test showed a long run association between the studied variables. The error correction model showed a strong and positive association between administrative and economic services and the rate of economic growth in Nigeria. However, the distributed lag models can be problematic when the lag length is long, especially in small samples.

3. Methods

The section presents the sources and method of data collection, estimation procedure and model specification.

3.1 Sources and method of data collection

The time series data on manufacturing output, inflation and bank credit to commercial banks from 1986 to 2021was employed for this study. The data are sourced from the Central Bank of Nigeria and the Vector Error Correction technique was used for the estimation.

3.2 Measurement of Variables

Manufacturing Sector Output: MSO: This entails output in the sector which comprises; oil refining, cement, food, beverage and Tobacco, Textile, Apparel and Footwear, Wood and Wood products, Pulp, paper products, chemical and pharmaceutical products, and non-metallic products. This is measured in Naira.

Inflation: CPI: is measured as annual percentage change in the consumer price index.

Government capital expenditure: GCE: This is the Expenditure on infrastructures which entails buildings, constructions of bridges, railways, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles in the economy. It is expressed in Naira.

Bank Credit: BC: Bank credit to manufacturing sector is the total credits avail to the manufacturing sector by the banking sector in Nigeria in a year. It is proxy as bank credit to the manufacturing sector in monetary term (Naira)**.**

3.3 Estimation Procedure

Before the application of the VECM technique, the stationarity test was conducted using ADF, optimal lag length was also estimated. Co-integrated test was done through the Johanson co-integration test. Short run dynamics and the error correction model were captured. To ensure the reliability of the result, serial correlation, heteroskedasticity, normality and stability tests were carried out.

3.4 Model Specification

The functional model for the study is presented as;

MSO =F(GCE, CPI, BC) (1)

MSO = Manufacturing sector output

GCE= Government Capital Expenditure

CPI= Consumer Price Index Proxy as Inflation

BC= Bank Credit to Deposit Money Banks

Equation one is transformed to an econometric model and logged to avoid heteroscedasticity as thus;

$$\mathbf{MSO}=\mathbf{B_0} + \mathbf{B_1}GCE + \mathbf{B_2}CPI + \boldsymbol{B_3}BC + £ \quad (2)$$

Where; $\mathbf{B_0}$ is the constant, $\mathbf{B_1}$, $\mathbf{B_2}$, and $\boldsymbol{B_3}$ are the parameters of the variables under study.

The research adopts the VECM model following the research of Okoro (2013).The reason for applying the VECM is to explain the speed of adjustment . The VECM has co-integration relation built into the model so that it restricts the long term behavior of the endogenous variables to converge to their co-integrating relationship while allowing for short term dynamics adjustments. The conditional VECM can be specified as follows:

$$\Delta \mathbf{lMSO}_t = \mathbf{a_1} + \Delta \mathbf{lMSO}_{t-1} + \Delta \mathbf{lGCE}_{t-1} + \Delta \mathbf{lCPI}_{t-1} + \Delta \mathbf{lBC}_{t-1} + \lambda_1 \mathbf{ECM}_{t-1} + \mu_{1t} \quad (3)$$

Where:

Δ= Difference operator

a_1= constant or the intercept

λ= speed of adjustment with a negative sign.

μ_t= residuals (stochastic error term)

l= Common logarithm (LOG)

4.0 Analyses and Discussion of Result

4.1 Unit Root Test

It is very important to test whether the time series data are stationary or otherwise. Augmented Dickey-Fuller (ADF) test was used to find the order of integration. This test showed how many times a variable need to be differenced to become stationary.

Table 1: Unit root test results from Augmented Dickey Fuller Test at first difference

Variables	ADF at 1st Difference	Critical value at 5%	Order of integration
LMSO	-3.986601	-3.552973	I(1)
LGCE	-5.367665	-2.960411	I(1)
LCPI	-8.561904	-1.951332	I(1)
LBC	-7.886537	-2.954021	I(1)

Source: Author's computation from Eviews9

Decision rule:

If t* > ADF critical value = do not reject null hypothesis, i.e., unit root exists.

If t* < ADF critical value = reject null hypothesis, i.e., unit root does not exist.

The unit root/stationary test result in Table1 reveals that the variables are 1(1). They are non-stationary at the levels but become stationary after the first difference. Since t* < ADF critical value, it is therefore necessary to conclude that all the series are integrated of the first order 1(1).

This outcome suggests the need for co-integrated test to know whether there exist long- run relationships among the variables.

Table 2: Co-Integration Test

(a) Unrestricted Co-integration Rank Test (Trace Statistics)

Hypothesized No CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
At most 1 *	0.497600	36.76359	29.79707	0.0067
At most 2	0.281189	14.04777	15.49471	0.0816
At most 3	0.091112	3.152609	3.841466	0.0758

Source: Author's computation from Eviews9

(b) Unrestricted Co-integration Rank Test (Ma**ximum Eigenvalue)**

Hypothesized No CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.675906	37.18180	27.58434	0.0022
At most 1 *	0.497600	22.71582	21.13162	0.0297
At most 2	0.281189	10.89516	14.26460	0.1595
At most 3	0.091112	3.152609	3.841466	0.0758

Source: Author's computation from Eviews9

Tables 2(a) and 2(b) present Trace Statistics and the Maximum Eigenvalue respectively; the tables indicate the presence of one co-integrating equilibrium relationship among the variables under study. This necessitates the use of Vector Error Correction Model, to know the speed of adjustment from short run to long run.

Table 3: The estimated long run co-integration vector with LMSO as dependent variable

Variable	Coefficients	T- statistics
LGCE	13.268	6.135
LCPI	-4.0130	-2.112
LBC	-6.751	-5.558

Source: Author's computation from Eviews 9

The estimated long run co-integration vector is reported in Table 3, reveals that Government capital expenditure have negative relationship with manufacturing output while Inflation and bank credit on deposit money banks have negative relationship with manufacturing output. The results depicts that the variables understudy have significant effect on the manufacturing output in Nigeria. The result of the estimation implies that an increase in Government capital expenditure will increase manufacturing sector output by 13.26%. This denotes that an increase in Government capital expenditure will augment the manufacturing output sector output. Government capital expenditure in roads, transportation, rail, air, electricity et cetera will help in boosting the sector by 13.26%. This in line with the study conducted by Emmanuel and Oladiran (2015). Put otherwise, an increase in inflation will decrease the manufacturing sector output by 4.01%. This impliedly means that increase in inflation will definitely decrease the sector's output. The result also revealed that bank credit on commercial banks has negative effect on manufacturing sector output. It denotes that a percentage increase on bank credit on deposit money bank will decrease the sector's output by 6.75%. Notwithstanding, this is contrary to expectation as bank credit is expected to ignite the sector's output. This is contrary to the study conducted by Efanga et al (2022).

Table 4: Short-run dynamics

Variable	Coefficients	T-statistics
ECM	-0.001889	-1.08012
LGCE	0.024432	1.464428
LCPI	-0.006304	-0.47226
LBC	0.037410	1.07997

Source: Authors' computation from Eviews 9

From table 4: The result of the ECM equation depicts that the errors committed in the short run towards long run is corrected in an adjustment speed of 0.18%. The result reveals that all the variables understudy are statistically insignificant. More so, it portrays that a percentage increase in government capital expenditure will augment manufacturing sector output by 2.4% at ceteris paribus in the short run. In addition, a percentage increase in inflation, decreases manufacturing sector output by 0.6% at ceteris paribus in the short run. Furthermore, a percentage increase of bank credit to deposit money banks increases manufacturing sector output by 3.7% at ceteris paribus in the short run.

Table 5: Post Estimation

TEST	NULL HYPOTHESES	CHI-SQUARE	P-VALUE	REMARKS
Residual Heteroskedasticity	No Serial Correlation	**438.6001**	**0.1205**	Accept null hypothesis
White Heteroskedasticity	No Heteroskedasticity	**207.3068**	**0.0797**	Accept null hypothesis
Normality Test	Residuals are multivariate normal	**15.92174**	**0.1019**	Accept null Hypothesis

The table 5: has shown the absence of Serial Correlation and heteroskedasticity, which means the data, is good and the results from the data can be taken seriously for policy recommendation. In addition, the normality test shows that the residuals are normally distributed. Therefore, the

results from the data used can be used for policy recommendation.

5.0 Conclusion and recommendation

Based on the findings of the study, the study concludes that Government capital expenditure has negative relationship with manufacturing output while Inflation and bank credit on deposit money banks have negative relationship with manufacturing output. The results depict that the variables understudy have significant effect on the manufacturing output in Nigeria. The study established the presence of long run equilibrium relationship among the variables under study

Based on the findings, the study recommends as follows:

1. Government should focus on building infrastructure such as electricity plants, bridges, roads, pipe-borne water, and other infrastructures that will help in boosting the manufacturing sector output. The infrastructures will help in bringing local and foreign investors and will help in providing employment generation, increase in standard of living, reducing poverty and increasing the manufacturing sector's output which will translate in the overall GDP of the economy.
2. The government should try to reduce inflation rate as it deteriorate the manufacturing sector's output. Inflation discourages investors because of the uncertainties involved therein.

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