SOME MACROECONOMIC INDICATORS AND THE GROSS DOMESTIC PRODUCT OF NIGERIA: AN IMPACT STUDY FOR ECONOMIC RECOVERY

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Abstract

The work presented the impact of some Foreign Macroeconomic Indicators on the Gross Domestic Product of Nigeria using linear regression method. The study employed linear regression approach with Gross National Product (GNP) and Foreign Domestic Product (FDI) as the predictors while the Gross Domestic Product (GDP) was the response variable. The parameters of the model are estimated alongside the coefficient of determination (R^2), and its adjusted (R^2_{adj}), variance inflation factor (VIF), P-values and T-values were also estimated. This paper revealed the level of significant contributions of both the Foreign Direct Investment (FDI) and the Gross National Product (GNP) to the Gross Domestic Product (GDP) of Nigeria Economy. The research revealed that imports of goods and services had a large positive impact on Nigeria's GDP, whereas other explanatory factors have a significant negative impact on GDP. Based on this finding, it is proposed that local products be improved so that Nigerian-made goods/products may compete well with imported goods and services, hence lowering importation naturally rather than forcibly.

Keywords: *GDP, FDI, GNP, Macroeconomic Indicators, Regression Analysis.*

1.Introduction

Gross National Product (GNP) represents the total worth of goods and services produced by a country's citizens during a specific time frame. It is computed by combining personal spending, government spending, domestic investments, net exports, and income earned by locals from foreign investments. The GNP calculation also involves deducting income received by foreign residents. In essence, it captures the overall economic activity generated by a nation's people, both within their borders and abroad. Gross Domestic Product (GDP) includes any output created within a country's boundaries, regardless of who owns the source of production. The GNP is associated with the GDP in that it starts with GDP and adds residents' investment income from oversea, while foreign resident's income earned within the country is subtracted from it. Foreign Direct Investment (FDI) is a type of inter-border investment in which an investor from another nation creates a long-term stake in another economy, hence exerting substantial influence over the enterprise of the other economy. It plays huge role in international economic integration.

According to Lane & Miles-Ferretti (2003), FDI exists when a firm invests in a project in another country by buying 10% and above share in that country.

Gross Domestic Product (GDP) represents a nation's economic production value, accounting for price changes due to inflation or deflation. It is derived from the total of consumer spending, industrial investments, net exports (exports minus imports), and government spending. When an economy experiences prolonged inflation, GDP tends to increase. The GDP of every nation is vital in comparing its economic activities to those of others, thus it is necessary to identify several elements that contribute considerably to the real GDP for intentional projection.

According to the IMF's updated World Economic Outlook (WEO), the Nigerian economy would now expand at a far slower rate than South Africa's, which is anticipated to increase at 0.1% in 2016. Nigeria's economic activity as was contracted in 2016 was seen to have low foreign currency due to its weak investor confidence, low power generation, and low oil price.

One of the most serious difficulties Nigeria is now experiencing is a recession, or an extremely terrible economic state. Nigeria has experienced cycles of prosperity, recession, and recovery in the past, and it finds itself once again in a period of recession. The current situation raises important questions about how the country reached this point and what actions policymakers and other stakeholders should take to navigate out of this challenging situation. People are eager to know when Nigeria will begin to recover and what measures can be implemented to kickstart the recovery process. As academics, we understand that a country's GDP serves as a crucial indicator of economic growth and well-being. Thus, understanding the trajectory of Nigeria's GDP and identifying factors that could boost its growth become pivotal aspects of our research in response to the present circumstances.

Regression analysis is a useful tool for modeling and analyzing data; it is useful for determining the link between two or more variables. Regression analysis aids in placing the data points along a curve and this equally aids in the modelling and analyzing of the data. Regression is used to measure and characterize the variables for evaluation of models and data sets. Regression model involves the representation of data that gives rise to a conclusive value of the coefficient. These coefficients can be estimated as statistical properties such as standard deviations, covariance, and correlations. Also, all the data must be available. Multiple Linear Regression model is an extension of the simple linear regression, encompassing two or more explanatory factors to predict a response variable. This powerful and flexible approach has become a fundamental tool in statistical analysis across various fields. The multiple linear regression model, as an extension of the simple linear regression, is a powerful and versatile tool used widely in statistical analysis across diverse fields. However, it is crucial to acknowledge that estimating complex models with numerous variables requires careful consideration and effort. While the multiple linear regression model is valuable, it has its limitations, as it is a static representation that may not fully capture the dynamic complexities of reality. The dynamic multiple linear regression model introduces a lag-dependent

unbiased variable, allowing for more accurate estimations by considering the influence of past values on present outcomes, particularly suitable for dynamic monetary events.

The study of how gross national products affect the gross domestic products in Nigeria has not been given much attention in the literature. Knowing quite well that gross national product has some factor of foreign income earned by the citizens of Nigeria and businesses done outside the shores or borders of Nigeria, it was taught wise to see how GNP and FDI affect the GDP. This paper investigates the combined influence of key foreign macroeconomic factors on Nigeria's GDP during a 20-year period, from 2000 to 2022. The work is designed to bring to limelight how some foreign indicators like GNP and FDI will affect the GDP of Nigeria.

2.**Review of Related Literature**

The existing literature has consistently demonstrated the positive impact of Foreign Direct Investment (FDI) on the economic development of host countries. FDI plays a vital role in transferring technical expertise and effective management practices to the host nation, resulting in numerous benefits such as job creation, increased productivity, and a higher GDP. Scholars have extensively studied the effects of FDI across various economic sectors, including commerce, manufacturing, banking, and general services. This study will conduct a comprehensive review of previous research, focusing particularly on the relationship between FDI and GDP. Okunnu, et al. (2017). conducted a research study investigating the impact of various macroeconomic indicators on Nigeria's economic development from 1970 to 2015. They included factors such as GDP, growth rate, gross national product, manufacturing value-added, external debt stock, inflation, trade, industry value added, and foreign direct investment as a percentage of GDP (FDI ratio) to determine inflows. Employing basic ordinary least squares (OLS) regressions, the researchers analyzed yearly FDI and other data from 1970 to 2015, using IMF and global financial information tables as their sources. The study aimed to uncover the relationships between these factors and FDI. Their findings indicated that independent variables like GDP, GNP, MVA, GDPC, and TRA significantly influenced FDI in Nigeria, as reflected by their low p-values (below 5%) in the T-statistic analysis. Their conclusions have consequences for politicians, the government, and investors. Onu and Victor-Edema (2021) analysed the GDP growth on some selected petroleum products using multiple regression. Three multiple linear models were compared, and the model with three interactions was recommended as the best fit. Ijomah et al. (2018) used logistic and poisson regression to investigate the association between a response variable and multiple predictor factors. The analysis included descriptive statistics and regression approaches. Additionally, logistic and Poisson regression models are valuable tools used to identify relevant factors and understand the direction of influence for each variable. These models facilitate the analysis of data between dependent and independent variables in a set of observations (Armstrong, 2012). Azeez, et al. (2012) conducted a study exploring the impact of exchange rate volatility on Nigeria's macroeconomic performance between 1986 and 2010. Their model considered real GDP as the dependent variable, with the exchange rate (EXR), balance of payment (BOP), and oil revenue (OREV) as proxies for independent variables. To evaluate both short and long-run effects,

they applied ordinary least squares (OLS) and Johansen co-integration estimation methods. The results of the ADF test confirmed that all variables were stationary. The OLS findings revealed a positive association between OREV and EXR with GDP, while BOP had an adverse relationship with GDP. They further observed that over time, oil revenue and balance of payments negatively affected GDP, while exchange rate volatility had a positive impact. Based on their findings, the researchers recommended addressing corruption in the oil sector, optimizing the utilization of oil revenue, and prioritizing the agriculture and solid mineral sectors. They also suggested implementing monetary policies to reduce inflation and maintain the stability of the national currency in the global market. According to World Bank databank sources (2020), foreign direct investment, net inflows (% of GDP) is defined as the net inflows of investment to acquire a long-term management interest (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor. This dataset represents the total of equity capital, earnings reinvestment, other long-term capital, and short-term capital as shown in the balance of payments. The data divides net inflows from foreign investors in the reporting country by GDP, indicating the significance of foreign direct investment in the country's economy. In a series of research studies, various scholars have delved into the impact of foreign direct investment (FDI) on Nigeria's economy and capital market. Adaramola and Obisesan, (2015) employed co-integration methodologies, including OLS, ADF, and Johansen, to investigate the relationship between FDI and market capitalization. They found no co-integration between the two variables but inferred that market capitalization still significantly influenced FDI. The study suggested that FDI had a favorable, though modest, impact on equities market growth and recommended the government's encouragement of foreign investment in non-oil industries. Agya, et al. (2015) used OLS and ADF unit root tests to explore the determinants affecting FDI in Nigeria from 1980 to 2013. Their findings revealed that per capita GDP, education, and trade openness positively contributed to FDI, while wage rate, infrastructure, and naira devaluation had negative impacts. They advised implementing policies to stimulate FDI in crucial sectors, including a stable exchange rate policy and improvements in the quality of education. Ndem, et al. (2014) conducted a study on FDI determinants and their consequences on Nigeria's economy, using OLS, co-integration, and error correction technique (ECM). The research showed that market size, openness, and currency rate positively influenced FDI inflows, while political risk and infrastructure investment had substantial negative effects. Nwankwo, O., et al. (2013) investigated the impact of globalization on FDI in Nigeria using descriptive narrative methodologies.

In a study conducted by Agwu et al. in 2020, the multiple linear regression analysis was employed to investigate how Nigeria's foreign debt impacted its GDP from 2014 to 2018. The findings suggested the importance of regulatory authorities, specifically the Debt Management Office, in implementing checkpoints to ensure that loans were utilized for their intended purposes. Additionally, the study recommended establishing borrowing benchmarks for states and federal governments, guided by well-defined criteria. By doing so, they aimed to enhance the effectiveness and accountability of debt utilization in the country.

3.Materials and Methodology

The data utilized in this study include statistics on Nigeria's Gross Domestic Product (GDP), Gross National Product (GNP), and Foreign Domestic Investment (FDI) from 2000 to 2022 sourced from the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN) statistical bulletin.
The linear regression model built for this research is given as

$$GDP = \beta_0 + GNP\beta_1 + FDI\beta_2 + \varepsilon \quad (1)$$

where GDP, GNP, and FDI are as defined while $\beta_0,\ \beta_1, and\ \beta_2$ are parameters to be estimated.

The output vector which is the victor of the response (GDP) is given as

$$\underline{GDP} = \begin{pmatrix} GDP_1 \\ GDP_2 \\ \vdots \\ GDP_n \end{pmatrix} \quad (2)$$

while the input matrix which is the matrix of GNP and FDI is given as

$$X = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \cdots & \vdots \\ x_{n1} & x_{n2} & & x_n \end{pmatrix} \quad (3)$$

whereas the weight vector of the model parameters are given as

$$\underline{\hat{\beta}} = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_n \end{pmatrix} \quad (4)$$

The residual vector is given as

$$\varepsilon = \begin{pmatrix} \varepsilon_0 \\ \varepsilon_1 \\ \vdots \\ \varepsilon_n \end{pmatrix} \quad (5)$$

The model in (1) is written in matrix form as

$$y = X\beta + \varepsilon \quad (6)$$

where $\varepsilon \sim N(0,\ \delta_\varepsilon^2 I_n)$ and $I_n = N \times N$ identity matrix as seen in Onu & Inamete, (2022)
Applying least square equation, given as

$$\underline{\hat{\beta}} = (X'X)^{-1}X'y \quad (7)$$

$$= (X'X)^{-1}X' \begin{pmatrix} GDP_1 \\ GDP_2 \\ \vdots \\ GDP_n \end{pmatrix} \quad (8)$$

The inverse of $X'X$ is obtained by finding the determinant of $X'X$ and the cofactor. The cofactor yields the minor and transposing the minor gives the adjoint-matrix. The inverse then becomes

$$(X'X)^{-1} = \frac{Adj(X'X)}{|X'X|}$$

Multiplying equation (2) by X' gives

$$X'y = X'\begin{pmatrix} GDP_1 \\ GDP_2 \\ \vdots \\ GDP_n \end{pmatrix}$$

The parameters are estimated using equation (8)

Coefficient of determination/ adjusted coefficient of determination

The coefficient of determination is given as seen in Keller & Warrack, (2003), Kutner, et al. (2005), and Onu & Inamete, (2022) as

$$R^2 = 1 - \frac{SS_E}{SS_T} = \frac{SS_R}{SS_T} \quad (9)$$

where SS_E is the Sum of Square Error and SS_T is the Sum of Square Total.

The adjusted coefficient of determination is given as

$$AdjR^2 = \frac{n-1}{n-p}\left(\frac{SS_E}{SS_T}\right) \quad (10)$$

where the Sum of Square as seen in Keller & Warrack (2003), Nwaogozie (2011) and Wonu, et al. (2023) as

$$SS_E = (n_1 - 1)S_1^2 + (n_2 - 1)S_2^2 + \ldots + (n_k - 1)S_n^2 \quad (11)$$

where p is the number of model parameters.

The coefficient of determination is affected by the number of model parameters, while the adjusted coefficient of determination is unaffected by the number of model parameters. The higher their values, the better the model fit.

T-test

The t-test is given as seen in Kutner, et al. (2005), Onu & Inamete, (2022)

$$t = \frac{\widehat{\beta}_0}{S(\widehat{\beta}_0)} \quad (12)$$

Regression Analysis: GDP versus GNP, FDI

Table 1:.GNP, GDP and FDI 2000-2022

YEAR	GDP	GNP	FDI
2022	490.45	487.21	2.56
2021	440.83	444.03	2.48

2020	432.2	421.34	2.39
2019	448.12	415.86	2.31
2018	421.74	392.47	0.78
2017	375.75	400.37	2.41
2016	404.65	461.01	3.45
2015	493.03	525.24	3.06
2014	574.18	533.51	4.69
2013	520.12	471.55	5.56
2012	463.97	416.34	7.07
2011	414.47	359.9	8.84
2010	366.99	342.31	6.03
2009	295.01	317.35	8.56
2008	339.48	297.73	8.19
2007	278.26	236.8	6.04
2006	238.45	192.52	4.85
2005	175.67	143.12	4.98
2004	135.76	117.96	1.87
2003	104.74	93.03	2.01
2002	95.05	81.09	1.87
2001	72.8	66.42	1.19
2000	69.45	57.03	1.14

Source: Macrotrends Stock Research, Science Academic Research, 2(5), 2000-2022.

Table 2: Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	11.1	14.8	0.75	0.462	
GNP	0.9557	0.0377	25.35	0	1.05
FDI	4.8	2.4	2	0.059	1.05

Table 3: Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
27.4328	97.22%	96.94%	96.28%

Table 4: Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	2	525994	262997	349.47	0
GNP	1	483657	483657	642.68	0
FDI	1	3023	3023	4.02	0.059
Error	20	15051	753		
Total	22	541045			

Regression Equation

GDP = 11.1 + 0.9557 GNP + 4.80 FDI

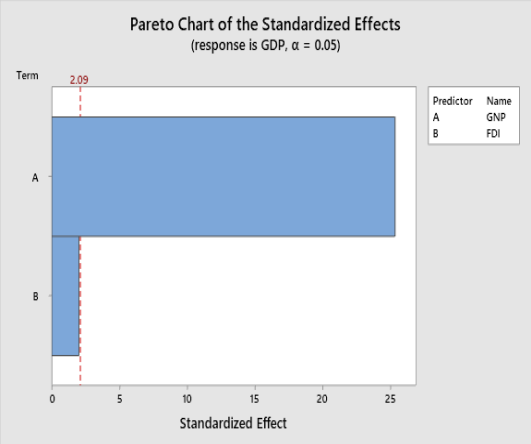

Figure 1: Pareto Chart of the Standardized Effects

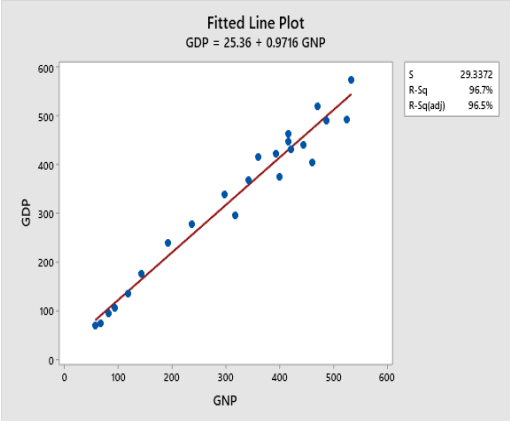

Figure 2: Fitted Line Graph of GDP vs. GNP

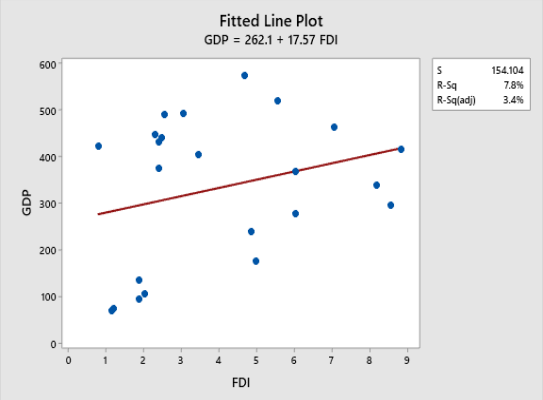

Figure 3: Fitted line graph of GDP vs. FDI

4.Discussion of Results

The regression equation reveals that Foreign Direct Investment (FDI) contributed about 4.80 to the Gross Domestic Product (GDP), while the Gross National Product (GNP) contributed to about 0.9557 to the GDP of Nigeria Economy. The T-Value of the GNP was found to be 25.35 with a p-value of 0.000, while the T-value of FDI was 2.00 with a p-value of 0.059. This shows that the GNP contributed more significantly to the GDP than the FDI in Nigeria. The Variance Inflation Factor (VIF) of 1.05 for both the GNP and FDI suggest that there is no multicollinearity in the data set. The coefficient of determination

and the adjusted coefficient of determination of 96.94% and 97.22% respectively reveals that the built model for this study was able to explain the very high variations in response variable. The analysis of variance shows that the regression equation was significant for the GNP, while the FDI was slightly significant. It also reveals that the null hypothesis of no significant difference was rejected, hence the alternative was not rejected.

The Pareto chart of standardized effects at 5% level of significance shown in figure 1, depicts that GNP has a higher level of standardized effect of 25 while the FDI has a minimal level of 2.09, this further shows that standardized effect was significant.

The plotted points in Figure 2, revealed that the points are closely spotted to the line of best fit. This implies that 96.7% of the total variation is accounted for by the regression model and the remaining 3.5% is due to error. In addition, it can be can see in Fig. 3 that the points are farther away from the line of best fit, with a total variance of 7.8% and an error of 92.2%. In general, the higher the R^2, the bigger the proportion of variance in GDP, that is., the better the regression model's goodness of fit to the sample data. The closer R^2 gets to zero, the poorer the fit (i.e., the model is insufficient). As a result, we acknowledged the study that there is a considerable difference between the means of GNP and FDI as it impacts Nigeria's GDP.

The study recommended that importation into Nigeria should not totally be stopped, but local production should be enhanced as well, this is because, importation brings about competition which reduces inflation in an economy. Again, between the two foreign based economic indicators (GNP and FDI), the GNP is a better indicator of the GDP than the FDI.

5.Contributions to Knowledge

The study contributed the following to knowledge base:

1. The GNP and FDI are good predictors of GDP, as evidenced in the values of the coefficient of determination and the adjusted.
2. GNP as a measure of the level of importation of a Country, is a better predictor to the GDP than the FDI which measures the amount of investment a country has outside the shore of the Country.
3. The revelation in the study as regards the weak performance of FDI means that a country having more FDI will likely invest less in the country, thereby denying the citizens of the country jobs that would have been created.

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