



RESEARCH ARTICLE

EFFECT OF SELECTED MACROECONOMIC VARIABLES ON THE NIGERIA ECONOMY

S.O. Jabaru and K. Jimoh

Department of Physical Sciences, Al-Hikmah University, Ilorin, Nigeria.

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Abstract

As the largest economy in Africa, Nigeria produces a large proportion of goods and services in the West African subcontinent and hence, her economy is affected by a number of micro and macro economic variables. The impact of some selected macroeconomic variables on the Nigeria economy for a period of thirty – eight years (1980 – 2017) was examined in this paper, using the gross domestic product (GDP) to represents the economy. At 5% significance level, only exchange rate and population growth rate significantly affects the Nigeria economy within the study periods. Unemployment rate (X_1) and crude oil exports (X_7) were found to be collinear, likewise exchange rate (X_3) and foreign direct investment in Nigeria (X_4). The error terms of the fitted model are positively autocorrelated while the error term of crude oil exports (X_7) is not normally distributed. This paper recommends to future researchers, transformation or increase in sample sizes of those variables that did not conform to multiple regression assumptions.

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Introduction:-

Nigeria as a nation with an emerging market, mixed economy and majorly middle-income, with increasing industrialized, fiscal, service, communications, technology and entertainment sectors is ranked as the 27th-largest economy in the world in terms of nominal GDP, and the 22nd-largest in terms of purchasing power parity. As the largest economy in Africa, it produces a large proportion of goods and services in the West African subcontinent (Manufacturing Sector Report, 2015). As at the end of the first quarter of 2019, Nigeria's population is put at 188.7 million with a gross domestic product of \$1.1 trillion at 0.8% growth, unemployment rate of 7.0% and Inflation rate of Consumer Price Index (CPI) was estimated as 16.5%.

Often, researchers in all aspect of human endeavours are interested in modelling the relationship between or among regressand or dependent variable(s) and regressor(s) (explanatory or independent variables). This model serves among other purposes, the functions of prediction (intrapolation or extrapolation) and control. Least squares estimation is one of the most important regression techniques used for parameter modelling but however, based on certain assumptions underlying its usage. Some of the assumptions that make least squares so attractive in terms of general model hypothesis and parameter significance testing are that the error terms are normally and independently distributed i. e. $e_i \sim NID(0, \sigma^2)$, no collinearity among the explanatory variables otherwise called independency of explanatory variables among others.

The parameters of a fitted model, will however, be biased, thereby leading to unreliable model or wrong conclusions if there is violation of one or more of these assumptions. Thus, diagnosing these assumptions may improve

regression estimations and hence, the need to examine the conformity of the fitted model to some of these regression assumptions by using some selected macroeconomic variables over a period of time. This research work obtained an equation for describing and predicting the relationship among selected important economic variables.

A number of studies have related the gross domestic product to some economic variables, some of which are {Song (2013), Nagarajan et al (2013), Headey and Hodge (2009), Bakoulas and Caglayan (2002), Akinlo (2004), Afolabi (2011) and Abdulrasheed (2005)}.

Literature Review:-

In order to study the impact of macroeconomic variables on economic growth in perspectives of different countries, a lot of studies have been carried out. Philip (2010) identified a unidirectional causality and no co-integrating relationship between Inflation and economic growth through Co-integration and Granger causality test in Nigeria between 1970 and 2005. Ayyoub et al (2011) considered the relationship between inflation and economic growth of Pakistan between 1972 and 2010 using the Ordinary Least Squares (OLS) regression and concluded that a significantly inverse relationship exists between inflation and economic growth. Faria and Carneiro [2001] studied Brazil economy between 1980 and 1997 and discovered that inflation had no impact on real output in the long run but have a negative impact on output in the short run. Mamo (2012) obtained a negative significant relationship between inflation and economic growth while studying 13 Sub Saharan Africa (SSA) countries for 1969 to 2009, In a study of twenty-two countries between 2004 and 2010, Anaripour (2011) explored the relationship between interest rate and economic growth and concluded that a negative relationship exist between the two variables.

Agalega and Antwi (2013) considered the economy of Ghana for 1980-2010 to examine the impact of inflation and interest on GDP. By running multiple linear regressions, a strong positive correlation between GDP, interest rate and inflation was identified by them and the variance of interest rate and inflation explained about 44% of the variability of GDP. They further added that GDP and inflation have a positive coefficient where interest rate and GDP have a negative coefficient. Inyama (2013) established that inflation was negatively related with real GDP and exchange rates and interest rates were positively related with inflation in Nigeria, based on the data of 1979 to 2010. [Karim et al, 2012] used the structural vector error correction model (SVECM) approach to study the relationship between economic growth, fixed investment, and household consumption in Malaysia and found out that household consumption and foreign direct investment impact significantly on GDP in short run only and in the long run, economic growth had a permanent impact on household consumption and investment.

In (2014), Tapsin and Hepsag found that GDP and household consumption expenditure are not negatively correlated by studying the GDP and household consumption expenditure data of EA-18 countries for 2000-2012. Semuel and Nurina in a study in 2015 examine the impact of inflation, interest rate, and exchange rate on GDP in Indonesia between June 2005 and December 2013 and concluded that inflation was significantly and exchange rate was insignificantly related with GDP. Mofrad (2012) examined the relationship between GDP, export, and investment in Iran for 1991-2008 and found that investment and export were significantly positive with GDP growth in the long-term.

Ahmed and Mortaza in the year 2005 studied the relationship between inflation and economic growth of Bangladesh for 1980 to 2005. They used real GDP for representing economic growth and consumer price index (CPI) to denote inflation. Their study concluded that inflation and economic growth were negatively related in the long-term. Rahman (2014) examined the inflation and economic growth relationship in Bangladesh during 1976 to 2011 using vector auto-regression (VAR) and discovered a statistically significant negative relationship between inflation and economic growth while a study covering the period of 2000-2012 concluded that inflation rate and GDP growth were positively correlated in Bangladesh [Abdullah et al, 2012]. From the above discussion on related literatures, it can be understood that the study on macroeconomic variables and economic growth has received enormous attention from various researchers.

Research GAP: No single study has examined the combined effect of all the seven selected variables considered in this paper (Unemployment Rate, Inflation Rate, Exchange Rate, Foreign Direct Investment, Population Growth Rate, Age Dependency Ratio (ADR) and Crude Oil Exports) on the economy of Nigeria.

Methodology Of The Study:-

This study uses secondary data obtained from the following website addresses: www.theglobaleconomy.com, www.CEICDATA.Com, www.factfish.com and <https://data.worldbank.org/country/Nigeria/indicator>. It covered a period of thirty-eight years. The data contained the Gross Domestic Product (GDP) in billion Naira, which served as the economy (dependent variable), and the independent variables: Unemployment Rate (UR) (X_1) in (%), Inflation Rate (IR) (X_2) in (%), Exchange Rate (ER) (X_3) of \$1 to Naira, Foreign Direct Investment (FDI) (X_4) in billion dollars, Population Growth Rate (PGR) (X_5) in (%), Age Dependency Ratio (ADR) (X_6) in (%) and Crude Oil Exports (COE) (X_7) in (million barrels). Descriptive and inferential statistics were used to analyze the data, including model fitting and test of some basic assumptions.

Results:-

Table 1a:- Descriptive measures of the selected macroeconomic variables.

Measures	UR	IR	ER	FDI
Mean	4.8847	19.2658	80.5053	2.6716
Standard Error	0.1668	2.8037	13.0354	0.4197
Standard Deviation	1.0282	17.2834	80.3556	2.5870
Skewness	0.9196	1.8127	0.7810	1.1161
Minimum	3.5	5.4	0.5	0.19
Maximum	7.06	72.8	305.8	8.84
Count	38	38	38	38

Source: Authors' computation, 2020

Table 1b:- Descriptive measures of the selected macroeconomic variables.

Measures	PGR	ADR	COE	GDP
Mean	2.5882	89.0779	1780.263	140.6292
Standard Error	0.0131	0.3250	70.74837	27.5753
Standard Deviation	0.0808	2.0035	436.1223	169.9858
Skewness	0.9280	0.5556	-0.3101	1.3802
Minimum	2.488	86.598	900	15.789
Maximum	2.858	92.743	2500	568.499
Count	38	38	38	38

Source: Authors' computation, 2020

Table 2a:- Skewness values and interpretation for the macroeconomic variables.

Variable	UR	IR	ER	FDI
Skewness	0.9196	1.8127	0.7810	1.1161
Interpretation	Moderately skewed	Asymmetric	Moderately skewed	Asymmetric

Source: Authors' computation, 2020

Table 2b:- Skewness values and interpretation for the macroeconomic variables.

Variable	PGR	ADR	COE	GDP
Skewness	0.9280	0.5556	-0.3101	1.3802
Interpretation	Moderately skewed	Moderately skewed	Symmetric	Asymmetric

Source: Authors' computation, 2020

Table 3:- Estimated regression parameters and their p-values.

Variable	β_i	p-value	Decision
(Constant)	-3426.064	.013	$p < 0.05$
Unemployment Rate (%)	-42.941	.070	$p > 0.05$
Inflation Rate (%)	-.428	.650	$p > 0.05$
Exchange Rate (\$1 to naira)	1.882	.000	$p < 0.05$
Foreign Direct Investment (%)	6.238	.559	$p > 0.05$

Population Growth Rate (%)	695.380	.006	p < 0.05
Age Dependency Rate (%)	21.949	.113	p > 0.05
Crude Oil Exports (million barrels)	-.078	.334	p > 0.05

Source: Authors' computation, 2020

Table 4: Test for the significance of the overall model.

Source of variation	Sum of Squares	Df	Mean Square	F-cal	p-value	Decision
Regression	845330.271	7	120761.467	16.189	.000	p < 0.05
Residual	223790.766	30	7459.692			
Total	1069121.037	37				

R² = 0.7906

Source: Authors computation, 2020

Table 5:- Pairwise correlation coefficient among the explanatory variables.

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇
X ₁	1						
X ₂	-0.009	1					
X ₃	-0.163	-0.333	1				
X ₄	-0.458	-0.258	0.678*	1			
X ₅	0.151	-0.311	0.223	0.433	1		
X ₆	0.392	0.347	-0.669*	-0.486	-0.035	1	
X ₇	-0.609*	-0.275	-0.676*	0.708*	0.192	-0.794*	1

Source: Authors computation, 2020

Table 6:- Test for multicollinearity among independent variables.

Dimension	Eigen Value	Condition Index	Const.	UR	IR	ER	FDI	PGR	ADR	COE
1	6.652	1.000	.00	.00	.00	.00	.00	.00	.00	.00
2	.850	2.798	.00	.00	.12	.05	.04	.00	.00	.00
3	.295	4.750	.00	.01	.66	.01	.07	.00	.00	.00
4	.157	6.514	.00	.00	.06	.50	.31	.00	.00	.00
5	.039	12.991	.00	.16	.00	.00	.25	.00	.00	.12
6	.006	32.042	.00	.67	.04	.29	.01	.01	.00	.47
7	.000	132.858	.04	.16	.08	.04	.21	.99	.06	.05
8	6.638E-5	316.568	.96	.00	.02	.10	.09	.00	.94	.36

Source: Authors computation, 2020

Table 7:- Test for normality of the error terms .

Variable	p-value (Shapiro-Wilk test)
unemployment rate (%)	.000
inflation rate(%)	.000
exchange rate (\$1 to naira)	.000
foreign direct investment (%)	.000
population growth rate(%)	.007
age dependency rate(%)	.002
crude oil exports(million barrels)	.254
gross domestic product in billion naira	.000

Discussion Of Results:-

The average values of the selected variables between 1980 and 2017 are: 140.6292 billion Naira, 4.8847%, 19.2658%, 80.5053 Naira to one dollar, 2.6716 billion dollars, 2.5882%, 89.0779% and 1780.263 million barrels for the Nigeria's Gross Domestic Product, Unemployment Rate, Inflation Rate, Exchange Rate, Foreign Direct Investment, Population Growth Rate, Age Dependency Rate and Crude Oil Exports respectively. The skewness coefficient for Unemployment Rate, Exchange Rate, Population Growth Rate and Age Dependency Rate showed

that their data are moderately skewed (equal number of observations above and below the mean score) while the skewness coefficient for Crude Oil Export is approximately symmetric which implies that the distribution of values for this data is evenly spread. However, the data for Inflation Rate and Foreign Direct Investment are asymmetric.

The model that represents the relationship among the variables is:

$$\hat{Y} = -3426.064 - 42.941X_1 - 0.428X_2 + 1.882X_3 + 6.238X_4 + 695.380X_5 + 21.949X_6 - 0.078X_7 \quad (1)$$

From equation 1, the rate of change in GDP with respect to a unit change in unemployment rate (X_1), holding all other variables constant is (-42.941); the rate of change in GDP with respect to a unit change in inflation rate (X_2), holding all other variables constant is (-0.428), the rate of change in GDP with respect to a unit change in exchange rate (X_3), holding all other variables constant is (1.882); the rate of change in GDP with respect to a unit change in foreign direct investment in Nigeria (X_4), holding all other variables constant is (6.238); the rate of change in GDP with respect to a unit change in population growth rate (X_5), holding all other variables constant is (695.380); the rate of change in GDP with respect to a unit change in age dependency rate (X_6), holding all other variables constant is (21.949) and the rate of change in GDP with respect to a unit change in crude oil exports (X_7), holding all other variables constant is (-0.078).

This implies that increase in the unemployment rate (X_1) by one unit, holding other variables constant will lead to a decrease of \$42.941b on the GDP. Similarly, increase in the inflation rate (X_2) and crude oil exports (X_7) by one unit, holding other variables constant will lead to a decrease of \$0.428b and \$0.078b respectively on the GDP. On the other hand, increase in the exchange rate (X_3) by one unit, holding other variables constant will lead to an increase of the GDP by \$1.882b. Also, increase in the foreign direct investment in Nigeria (X_4), population growth rate (X_5) and age dependency rate (X_6) while holding other variables constant will lead to an increase of \$6.238b, \$695.38b and \$21.949b on the GDP respectively.

Global test (F – test) was used to examine the overall significance of the fitted model. The null hypothesis for this test was “macroeconomic variables do not have significant impact on economic growth of Nigeria”, where alternative hypothesis assumed a significant impact. In the above analysis, it is observed that 79.06% variation in the economy as represented by GDP can be explained by the selected macroeconomic variables as characterized by Unemployment Rate, Inflation Rate, Exchange Rate, Foreign Direct Investment, Population Growth Rate, Age Dependency Rate and Crude Oil Exports. The p - value (0.000) is small enough to calls for the rejection of the null hypothesis. This relationship is found statistically significant at 95% confidence level. The individual parameters of the model ($\hat{\beta}$'s) were examined using local test (t- test) for their significance. With the following respective p-values: 0.070, 0.650, 0.000, 0.559, 0.006, 0.113 and 0.334, it was discovered that the p-values of exchange rate and population growth rate are less than the level of significance which calls for the rejection of their null hypothesis.

In the multicollinearity test, since there are more than two variables with variance proportions greater than or equal to 0.50, which also corresponds to large condition indices, there is collinearity in the data. The Durbin-Watson statistic test for autocorrelation of the error terms gives a value of 0.743, which lies between 0 and 2 indicating positive autocorrelation. In the test for the normality of the error terms, the Shapiro-Wilk test shows that only the p-values of crude oil exports is greater than the significance level (0.05).

Conclusion And Recommendations:-

The parameter values shows that increase in the unemployment rate (X_1), inflation rate (X_2) and crude oil exports (X_7) will lead to decrease of the GDP while increase in exchange rate (X_3), foreign direct investment in Nigeria (X_4), population growth rate (X_5) and age dependency rate (X_6) will lead to increase of the GDP.

It was discovered that the rate of inflation is negatively related with the Gross Domestic Product (GDP) which is in line with the findings of Ayyoub et al [2011], Faria and Carneiro [2001], Mamo [2012], Inyama [2013], and Rahman [2014]. Also, exchange rate is positively related with GDP which negates the findings of some studies i.e. Anaripour [2011], Kibria et al [2014], and Agalega and Antwi [2013]. Unemployment rate is also negatively correlated with the gross domestic product which contrasts the work of Agbodike (2012) and Adeleke (2013). However, Foreign Direct Investment (FDI) is positively associated with the Gross Domestic Product (GDP) which is in line with the findings of Ayanwale (2007). In the same vein, Population Growth Rate (PGR) is positively related

with the Gross Domestic Product (GDP) which matches the findings of Headey & Hodge (2009). Age Dependency Rate (ADR) is equally positively linked with the Gross Domestic Product (GDP) which is in contrast with the findings of Song (2013) but in line with the findings of Safdari et al (2011) and Thuku et al (2013). Lastly, Crude Oil Export (COE) is negatively related with the Gross Domestic Product (GDP) which is in contrast with the findings of Apere and Ijeoma (2013) which says there is no significant relationship between the variables.

The test for the presence of multicollinearity among the explanatory variables showed that unemployment rate (X_1) and crude oil exports (X_7) are collinear, likewise exchange rate (X_3) and foreign direct investment in Nigeria (X_4). The test for the presence of autocorrelation among the error terms revealed the presence of positive autocorrelation among them. The test for the normality of the error terms revealed that the error terms of crude oil exports (X_7) are not normally distributed. Since it was found that only exchange rate and population growth rate significantly affects the GDP values within the period in this study, a better model for predicting the gross domestic product based on the selected variables in this study is recommended as: $\hat{Y} = -3426.064 + 1.882X_3 + 695.380X_5$. Also to future researchers, those variables whose error terms are not normally and independently distributed in this study can be transformed. The sample size can also be increased (if possible) or transformation of collinear variables can be done to solve multicollinearity problem. To the government, those variables that are found to decrease the gross domestic product should be improved upon.

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