

MODELING SOME SELECTED MICRO-ECONOMIC VARIABLES ON ECONOMIC GROWTH OF NIGERIA VIA REGRESSION MODEL

***Amusa, S.O., Kuku-Aregbesola., Bamidele, G.I., Idowu, E.O., Ajiboye, Y.O and Fadiji. A.A**

Department of Statistics, Yaba College of Technology, Yaba-Lagos State.

***Corresponding author:** saidi.amusa@yabatech.edu.ng

Manuscript received on the 20/09/22 and accepted on the 15/12/22

ABSTRACT

Measuring gross domestic product has been a challenge to econometricians over the years as different macroeconomic variables have been employed by several investigators with varied results but the subject still remains a topical issue. This study examined empirical dynamic relationship between some selected macroeconomic variables on the growth of Nigeria economy. Secondary data was obtained from the World Bank online database which covered a period of thirty-six years (1985– 2021). The variables employed were the Gross Domestic Product (GDP) in billions of Naira, Population Growth Rate (PGR) in (%), Exchange Rate (ER) of Dollar to Naira, Interest Rate (INR) in (%) and Inflation Rate (IR) in (%) and Statistical Package for Social Sciences (SPSS) IBM Version 23.0 was employed in analyzing the data. The fitted regression equation for this model was: $GDP = -1.629E+12 + 6.843E+11*population\ growth + 1088791164*exchange\ rate + 641376491*inflation\ rate + 1076243147*interest\ rate$. Therefore, the study found that population growth and exchange are statistically significant in inferring gross domestic product. It is recommended that the apex banking body in Nigeria should put in place a stringent foreign exchange control mechanism to ensure that value of Naira against other currency is appropriately determined and steps should be taken to reduce inflation in the country by implementing different tools to control the circulation of money in the economy.

Keywords: Gross Domestic Product, Macroeconomic Variables, Population Growth Rate, Interest Rate, Exchange Rate, Regression Technique

1.0 INTRODUCTION

The effective and efficient coordination of the macro-economic variables (MEVs) will determine the growth of the economy as it would aid the provision of social amenities and betterment of lives for the teeming masses. Economic growth is the rise in the total output of a country over a specified period of time which is also known as gross domestic product (GDP). Dawuk et al(2022) asserted that gross domestic product is determined by various macroeconomic indices which include but not limited to exchange rate, inflation, government expenditure, capital mobilization visa viz: well-functioning of the financial sector, human capital development and index of industrial production among others. Temple (2002) reiterated that traditionally, inflation

and economic growth are negatively correlated, because the higher the prices of commodities less the purchasing power of money and more people will be reluctant to spend while a reduction in spending would result in low production of goods and services, which ultimately decrease the GDP. Similarly, if government expenditure is high and there is no corresponding monetary policy measure to cope with inflation, there will much money in circulation resulting in inflation. The purchasing power of money for productive activities would be eroded, hurting the total output within that period of budget implementation. However, the liquidity mops up measure, higher government spending would lead to capital accumulation which will enhance production, there increasing the GDP. Nkomo (2006)

found out that there was a reduction in gross domestic product (GDP) in Japan and China as a result of exchange rate implementation but an increment is recorded in Russia. Dyson (2010) opined that the reduction in the number of deaths is a principal causal factor for economic development and hence, the need for upgrading of the living standard of people. Headey and Hodge (2009) explained that increase in population will enhance productivity thereby producing positive effect on per capita GDP growth in the long run. Song (2013) used Ordinary Least Square method to examine the effects of demographic changes on economic growth in thirteen Asian countries between 1965 and 2009 and discovered that total population and the young population had negative growth impact on the economic growth of the selected Asian countries. Thuku, Paul and Almadi (2013) used Vector Auto Regression estimation technique to examine the impact of population change on economic growth in Kenya and it was observed that increase in population growth resulted in the increase in economic growth. Zhang et al (2013) studied the demographic transition in relation to economic growth in China and discovered that changes in age structure correlate significantly with economic growth rates. There has been several efforts at explaining gross domestic product in Nigeria over the years as different microeconomic variables have been employed by different investigators with varied results. The interest rate fluctuations on economic growth in Nigeria was investigated so as to determine their relationship, and the difference in the economic growth before and after interest rate deregulation regime in Nigeria (Udoka & Roland, 2012). Danmola(2013) analyzed the impact of exchange rate volatility on macroeconomic variables using various statistical tools of correlation matrix, ordinary least square (OLS) and Granger causality test and showed that exchange rate volatility has a positive influence on gross domestic product, foreign direct investment and trade openness and negative influence on

the inflationary rate in the country. Oriakhi and Osaze(2013) used Vector Auto regression (VAR) methodology to study the significance of oil price fluctuations on the developmental rate of Nigerian economy from 1970 to 2010 and discovered that there is a positive relationship between the variables. Ebele *et al*(2015) reviewed the effect and implication of selected macroeconomic variables on money supply employing derived secondary data obtained from central bank statistical bulletin Econometric tools of ordinary least squares, causality test and cointegration were used to analyzed the data. The authors found out that there is a long run relationship between the variables employed, and inflation has an inverse significant effect on money supply and exchange rate while other variable like GDP was found to have a positive impact on money supply. Ajayi et al(2017) assessed the effect of interest rate on economic growth of Nigeria. Error-correction mechanism technique was considered to test for the short and long-run relationship among the variables in the study. Results however indicate that there is both causal and unidirectional relationship between saving deposit and gross domestic product which implies that saving deposit contributes significantly to interest rate and economic growth. Anyanwu et al(2017) studied exchange rate policy in relation to Nigeria's economic growth using various statistical tools like ordinary least square estimation method, Johansen-Cointegration analysis and Granger causality technique. Findings showed that there is a positive but insignificant relationship between real exchange rate and real gross domestic product while real exchange rate affect manufacturing capacity utilization significantly within the period of study (i.e. 1986-2015). Ogunleye et al(2018) explored the impact of population growth on the economy of Nigeria over the period of 1981-2015. The variables employed were population growth rate, fertility rate, and crude death rate while ordinary least square regression tool was used to analyzed the data.

The findings of the study showed that population growth has a positive significant effect on economic growth in Nigeria while exchange rate and crude death rate are however insignificant for economic growth in Nigeria. George et al(2018) investigated the impact of money supply on microeconomic variables in Nigeria with the aim of evaluating the impact of narrow money supply, broad money supply and exchange rate on gross domestic supply and consumer price index differently. Stationarity test was conducted for each of the variable and ordinary least square method of estimation was employed to estimate the parameters of the model. Empirical evidence revealed that narrow money supply has a positive significant effect on inflation and real gross domestic product while broad money supply does not. It was further concluded that economic growth and inflation is a function of money supply and exchange rate in Nigeria. Utile et al (2018) worked on the effect of interest rate on the growth of Nigerian economy. The study adapted secondary data obtained from statistical bulletin of the central bank from 1980-2016. Multiple regression analysis was used to analyzed the data. Results showed that interest rate and exchange rate have negative and insignificant effect on gross domestic product. Omojuyigbe et al (2021) examined the impact of consumer price index on economic growth in Nigeria so as to explain the relationship between inflation on economic growth in Nigeria. Vector error correction model was employed to analyzed the data that covered between 2010-2018 and it was observed that there is a short-run relationship between consumer price index and gross domestic product (GDP). Jabaru & Kamoru(2021) evaluated the impact of some

selected macroeconomic variables on Nigeria economy by considering variables such as GDP, exchange rate, unemployment rate, crude oil exports, foreign direct investment and population growth rate. Multiple regression analysis was used to analyzed the data. It was observed that collinearity exists between two of the variables and values of the error term of the fitted model were positively autocorrelated which violated the assumptions of multiple linear regression. Summary results however showed that exchange rate and population growth rate significantly affect Nigeria economy. Ewubare & Ushie (2022) examined the relationship between exchange rate and economic growth in Nigeria between 1981 and 2020. The authors used descriptive statistics, unit root as well as bounds cointegration tests and Autoregressive distributed lag model to analyzed the secondary data collected from central bank of Nigeria statistical bulletin and World development indicators and found that exchange rate and inflation negatively impacted on economic growth. The need to carry out this study(Research gap) is anchored on the fact that microeconomic variables like population growth rate, exchange rate, interest rate and inflation rate are considered the major drivers of an economy. Hence, this work tends to build on earlier works by studying these variables collectively (i.e. exchange rate, interest rate and population growth) on economic growth of Nigeria.

METHODOLOGY

In this section, we adopt the model that relates the dependent variable (GDP) with the independent variables is given by:

$$Y = \alpha + \beta_0 + \beta_1 PGR + \beta_2 ER + \beta_3 INR + \beta_4 IN + e$$

where:

Y = Growth Rate (dependent variable),
 α = Constant,
 PGR = Population Growth Rate,

ER = Exchange Rate,
 INR = Interest Rate,
 IR = Inflation Rate,
 e = Error term,

$\beta_0, \beta_1, \dots, \beta_4$ are regression parameters. The dependent variable represents the economy is called the Gross Domestic Product (GDP) in billion Naira, while the independent variables such as: ($PGR = X_1$) in (%), ($ER = X_2$) of \$1 to Naira, ($INR = X_3$) in (%) and ($IR = X_4$) in (%). Also, Descriptive and inferential Statistics include: mean, standard error, skewness, test

of hypotheses etc were used to analyse the data.

We use secondary data obtained from website:

<https://databank.worldbank.org/source/world-development-indicators>. It covers a period of thirty-six years (1985 – 2021). The data consists the five (5) variables mentioned above. Therefore, Statistical Package for Social Sciences (SPSS) IBM Version 23.0 was employed in analyzing the data.

3.0 RESULTS

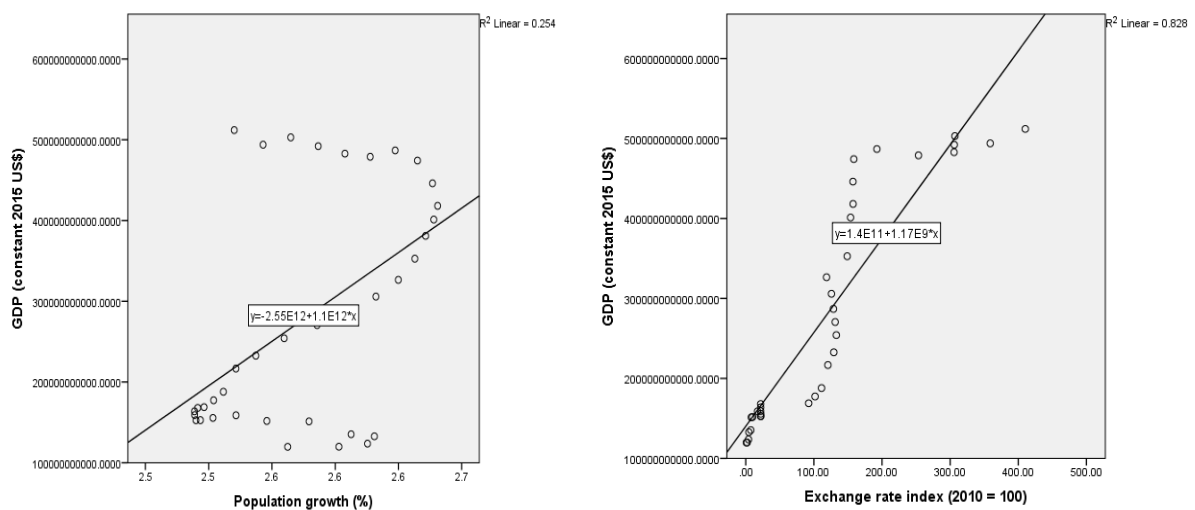


Fig. 1.0: Scatter Plots of GDP, Population growth, and Exchange rate of Nigeria

The result in fig 1 shows that there is a positive linear relationship between Gross Domestic Product and population growth

and same for exchange rate over the years under consideration.

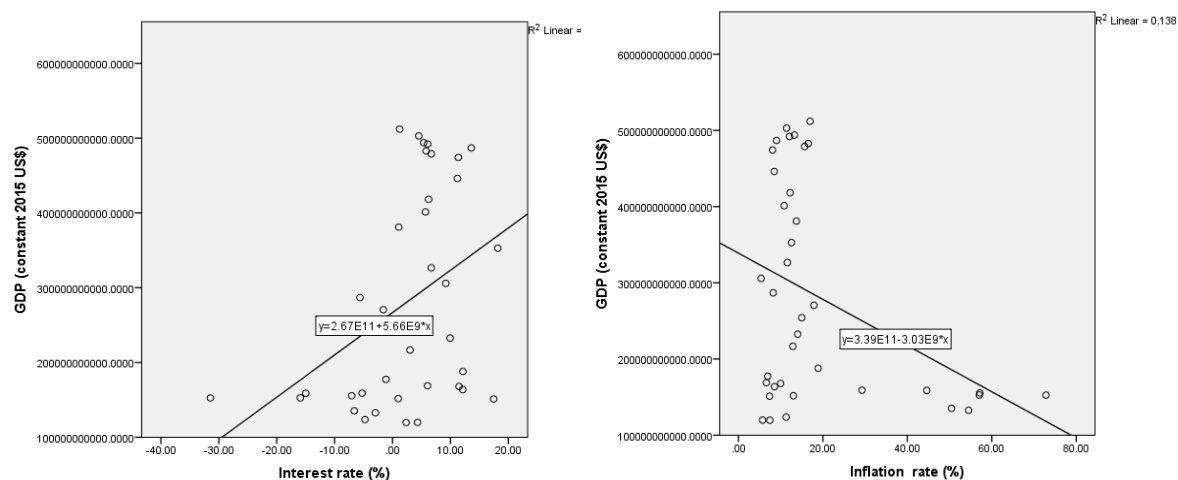


Fig. 2.0: Scatter Plots of GDP, Interest rate, and Inflation rate of Nigeria

The result in fig 2 shows that there is a positive linear relationship between Gross Domestic Product and interest rate whereas a

negative linear relationship exists between Gross Domestic product and inflation rate over the years under consideration.

Table 1.0: Summary of Inter-correlations among the variables (N = 36)

Variables	1[Y]	2[X ₁]	3[X ₂]	4[X ₃]	5[X ₄]
1. GDP (Constant 2015 US\$) [Y]	1				
2. Population growth (%) [X ₁]	.504**	1			
3. Exchange rate [X ₂]	.910**	.223	1		
4. Inflation rate (%) [X ₃]	-.372*	-.318	-.347*	1	
5. Interest rate (%) [X ₄]	.390*	.370*	.309	-.776**	1
Mean	2.809E+11	2.58	119.95	19.12	2.51
SD	1.422E+11	0.07	110.27	17.44	9.81

Note: ** indicates significance at $P < .01$

* Indicates significance at $P < .05$

The result in Table 3.1 showed that the independent variables are not highly correlated, hence, the need to fit the multiple regression model.

Table 2.0: Summary of Regression Analysis for Variables Predicting Real GDP (N = 36)

Independent Variables	Slope	Standard Error	t-ratio	Prob.
Population Growth	6.8434E+11	1.13721E+11	6.018	0.000
Exchange Rate	1088791164	66677112.5	16.329	0.000
Inflation Rate	1076243149	632220512	1.014	.318
Interest Rate	1076243149	1130004033	0.952	.384
Constant	1.62868E+12	2.92647E+11	5.565	0.000

Dependent Variable: GDP (constant 2015 US\$)

$R = .964$, $R^2 = .926$, $F(4,32) = 100.256$, $P = .000$

A significant regression equation was found [$F(3, 32) = 100.256$, $P < .05$], with $R^2 = .926$, which implies that population growth, exchange rate, inflation rate and interest rate can jointly explain 92.6% of the total variation in the economy growth (GDP) of Nigeria leaving the remaining 7.4% unexplained. Hence, the fitted regression equation for this model was; $GDP = -1.629E+12 + 6.843E+11 \times \text{population growth} + 1088791164 \times \text{exchange rate} + 641376491 \times \text{inflation rate} +$

$1076243147 \times \text{interest rate}$. The relationship between variables was very strong ($R = .96$). Though, population growth ($\beta = .314$, $t(32)=6.02$, $p=.000$) and exchange rate ($\beta = .844$, $t(32)=16.33$, $p=.000$) had a statistically significant impact., but inflation rate, ($\beta=.079$, $t(32) =1.01$, $p=.318$) and interest rate ($\beta =.074$, $t(32)=.95$, $p=.348$) are not statistically significant. Therefore, the most important predictors of gross domestic product are population growth and exchange rate.

Table 3.0: Model Adequacy Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.964 ^a	.926	.921	4037983992 6.9410300	.521

a. Predictors: (Constant), Exchange Rate (%), Population growth (annual %), Inflation (annual %), Interest rate (%)

b. Dependent Variable: GDP (constant 2015 US\$)

Since the DW coefficient (0.5) is not equal to 2 this implicit absence of autocorrelation

Residual Analysis

Table 4.0: Residual Statistics

	Min	Max	Mean	SD	N
Predicted Value	1.115E+11	5.549E+11	2.81E+11	1.36861E+11	36
Residual	-7.573E+10	8.912E+10	-0.000	3866E+10	36
Std. Predicted Value	-1.238	2.001	.000	1.000	36
Std. Residual	-1.847	2.173	.000	.943	36

Dependent Variable: GDP (constant 2015 US\$)

The **Std. Residual** (Standardized Residual) minimum value is -1.85 and maximum value was 2.17 which shows that the residual was within an acceptable level of ± 3.29 . The implication of this is that our data do not have any outliers. Also, the mean and variance of the standardized residual is 0 and 1, which

indicates that the error are roughly normally distributed. Therefore, we conclude that residuals have a constant variance is approximately normally distributed (with a mean of zero), and independent of one another over time.

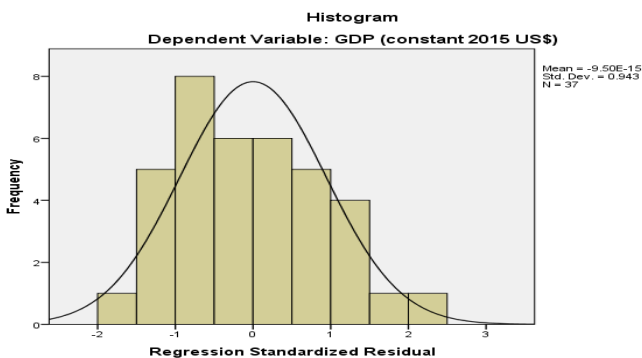


Figure 3.0: Histogram of residuals

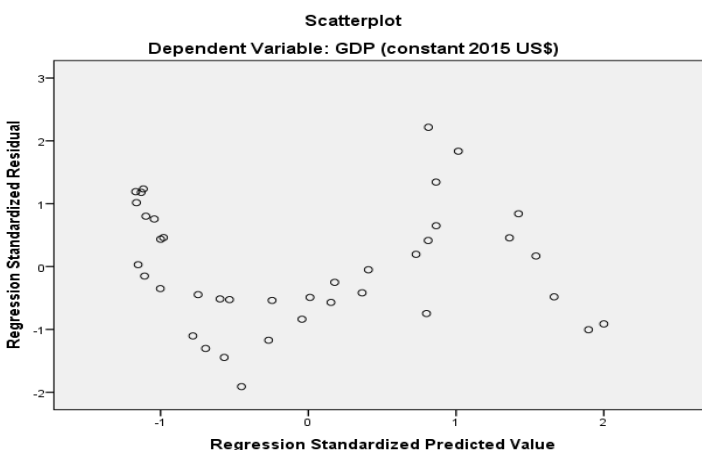


Figure 4.0: Scatter plot of residuals

4.0 DISCUSSIONS

The fitted regression model is Gross Domestic Product = $-1.629E+12 + 6.843E+11 \times \text{population growth} + 1088791164 \times \text{exchange rate} + 641376491 \times \text{inflation rate} + 1076243147 \times \text{interest rate}$.

The gross domestic product is predicted to increase by 6.843E+11 units of population growth, 1088791164 units of exchange rate, 641376491 units of inflation rate as well as the 1076243147 units of interest rate, and this association are statistically significant ($p < .05$). The overall model is significantly useful in explaining gross domestic product (GDP), $F(4,32) = 100.256, p < .05$. This model explains 92.6% of the variability in gross domestic product, and this is statistically significant at $\alpha = 0.05$. The test for the presence of multicollinearity among the explanatory variables showed that they are not highly correlated and values of the residual are not autocorrelated. Population growth is positively associated with gross domestic product which is in line with Headey and Hodge (2009), Obere et al (2013), Zhang et al (2013), and Utile et al (2018). Exchange rate is positively associated with gross domestic product. This agree with the findings of Danmola (2013), Anyanwu et al (2017) while Inflation rate is negatively associated with gross domestic product which is in line with the findings of Omojuyigbe et al (2021). It was however discovered that inflation rate and Interest rate do not have significant effect on gross domestic product of Nigeria while exchange rate and population growth rate significantly affect Nigeria economy which also in agreement with the work of Jabaru & Kamoru(2021).

5.0 CONCLUSION

This study examined empirical dynamic relationship among some selected macroeconomic variables on the growth of Nigeria economy. Secondary data was obtained from the World Bank online database which covered a period of thirty-six years (1985– 2021). The variables employed

were the Gross Domestic Product (GDP) in billions of Naira, Population Growth Rate (PGR) in (%), Exchange Rate (ER) of Dollar to Naira, Interest Rate (INR) in (%) and Inflation Rate (IR) in (%) and Statistical Package for Social Sciences (SPSS) IBM Version 23.0 was employed in analyzing the data. The study concluded that population growth and exchange rate are statistically significant in inferring gross domestic product which implies that as the population grows, this brings about preponderance increase in the gross domestic product while the more the devaluation of the currency, the higher economic growth would result as people will look inward at the expense of consumption of foreign goods. It is therefore recommended that the apex banking body in Nigeria should put in place a stringent foreign exchange control mechanism to ensure that value of Naira against other currency is appropriately determined and policy makers in Nigeria should take steps to reduce the inflation in the country by implementing different tools to control the circulation of money in the economy. For the generation of more deposits in banks, the interest rate should be stable. The study further proposes that policy makers should introduce high exchange rate to enhance the growth of Nigeria's economy.

REFERENCES

- Anyanwu, F. A., Ananwude, A. C., & Okoye, N. T. (2017). Exchange Rate Policy and Nigeria's Economic Growth: A Granger Causality Impact Assessment. *International Journal of Applied Economics, Finance and Accounting*. 1(1), 1-13. doi:10.33094/8.2017.11.1.13
- Ajayi, S.A., Oladipo, A.O., Ajayi, L.B., & Nwanji, T.I. (2017). Interest Rate and Economic Growth. The Case of Nigeria. *International Review of Business Research Papers*. 13(1), 141-150.
- Danmola, R.A. (2013). The Impact of Exchange Rate Volatility on the Macroeconomic Variables in Nigeria. *European Scientific Journal*. 9, No 7. ISSN: 1857-7881(Print). E-ISSN 1857-7431.

- Ebele, I., & Omotayo, A.F. (2015). Macroeconomic Variables and Money Supply: Evidence from Nigeria. *African Research Review: An International Multidisciplinary Journal*, Etiopia. 9(4). Serial No. 39 2015: 288-307. ISSN 1994-9057(PRINT). ISSN 2020-0083(Online).
- Ewubare, D. B., & Ushie, U. A. (2022). Exchange Rate Fluctuations and Economic Growth in Nigeria (1981- 2020). *International Journal of Development and Economic Sustainability*, 10(1), 41-55. doi:10.37745/ijdes.13.
- Dawuk, D.D., Yilkes, D.O. & Ali, G.M. (2022). Comparative Analysis of the Impact of Fixed and Floating Exchange Rates on Economic Growth in Nigeria. *Journal of Economics and Management Sciences*. 7(1), 1-18. ISSN: 2550-732X. Department of Economics, Federal University, Lafia-Nigeria.
- Dyson, T. (2010) *Population and Development: The Demographic Transition*. Bloomsbury Publishing.
- George, C., Suoyai, E., Lucky, T., & Bolokeye, M. (2018). The Impact of Money Supply on Some Microeconomic Variables in Nigeria. *Journal of Business Management and Economic Research*. 2, Issue 5, pp. 32-46. doi: 10.29226/TR 1001.2018.32.
- Headey, D. D. and A. Hodge (2009), "The effect of population growth on economic growth: a meta-regression analysis of the macroeconomic literature", *Population and Development Review*, 35(2): 221-48.
- Nkomo, J C. 2006. The Impact of Higher Oil Prices on Southern African Countries. *Journal of Energy Research in Southern Africa*, 17(1), 10-17.
- Ogunleye, O.O., Owolabi, O.A., & Mubarak, M. (2018). Population Growth and Economic Growth in Nigeria: An Appraisal. *International Journal of Management, Accounting and Economics*. 5(5), 282-299.
- Obere, A., Thuku, G.K., & Gachanja, P. (2013). *The Impact of Population Change on Economic Growth of Kenya*. Jems Publishers, Kenya.
- Jabaru, S.O., & Kamoru, J. (2021). Effect of Some Selected Macroeconomic Variables on Nigeria Economy. *International Journal of Advance Research*. 8(8), 1236-1242. doi: 1021474/IJARO11/11608
- Omojuyigbe, S.T., Agbonjinmi, S.A., & Bewaji, S.O. (2021). *Journal of Research in Humanities and Social Science*. 9, Issue 10, pp.35-41.
- Oriakhi, D.E., & Osaze, I.D. (2013). Oil Price Volatility and its Consequences on the Growth of the Nigerian Economy: An Examination (1970-2010). *Asian Economic and Financial Review*, 2013, 3(5):683-702. <http://aessweb.com/journal-detail.php?id=5002>.
- Song, S. (2013), "Demographic Changes and Economic Growth: Empirical Evidence from Asia", *Honors Projects*, pp. 121, http://digitalcommons.iwu.edu/econ_honproj/121.
- Temple, J. (2002). Inflation and Growth. *Stories Short and Tall. Journal of Economic Surveys*. 14(4), pp. 395-426. doi: org/10.1111/1467-6419.0016.
- Utile, B. J., Okwori, A. O., & Ikpambese, M. D. (2018). Effect of Interest Rate on Economic Growth in Nigeria. *International Journal of Advanced Academic Research, Social & Management Sciences*. ISSN: 2488-9849. 4(1), 66-78.
- United Nations Population Division. <https://databank.worldbank.org/source/world-development-indicators> (2019).
- Zhang, H., Zhang, H., & Zhang, J. (2013). Demographic Transition and Economic Growth: Evidence from Chinese Provinces. *Natural Science Foundation of China* 709, pp. 30-44.