

Econometric Analysis of Some Economic Indicators Influencing Nigeria's Economy.

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ABSTRACT

This research investigates the impact of some economic indicators on the Nigerian economy using data from the archives of the Central Bank of Nigeria and National Bureau of Statistics. The Durbin Watson test reveals that the data was free of autocorrelation. The Goldfield Quandt Test also indicates homoscedasticity. The Farrah Gluaber test shows multi-collinearity among the variables. Agricultural products, machinery, and transport have a positive linear relationship with the GDP while oil and inflation rate have a negative linear relationship with GDP.

(Keywords: economy, GDP, gross domestic product, Nigeria, inflation, oil, regression)

INTRODUCTION

Economic growth is the increase of per capita Gross Domestic Product (GDP) or other measure of aggregate income, typically reported as the annual rate of change in real GDP. Economic growth is primarily driven by improvement in productivity which involves producing more goods and services with the same inputs of labor, capital, energy, and materials.

The topic of economic growth is primarily concerned with the long term or long run. The long run path of economic growth is one of the central questions around; despite some problems of measurement, an increase of GDP of a country greater than population growth is generally taken as an increase in the standard of living of its inhabitants over a long periods of time, even small rates of annual growth can have large effect through compounding. There are some factors that are believed to have effect or impact on the economic growth or productivity of a nation such as; the exchange rate, interest rate, inflation rate,

inputs and output of labor, foreign trade and a host of others. However, for the purpose of this project work we shall be taking a look at the effect of inflation rate and importation on the nation's economic growth.

The economy of Nigeria is a middle income, mixed economy emerging market with well-developed financial, legal, communications, transports and entertainment sectors. Nigeria's GDP at Purchasing Power Parity (PPP) more than doubled from \$170.7 Billion in 2005 to \$374.3 Billion in 2010. It is the largest economy in the West Africa region, 3rd largest economy in Africa behind South Africa and Egypt and on track to becoming one of the top 30 economies in the world.

Krugman, et al. (1987) logically examined the effects of currency exchange rates on international trade. Currency exchange rates that promote lower prices for imports lessen inflationary pressures in the economy and have a downward push on interest rates in that country. Barro (1995) explores the inflation-economic growth relationship using a large sample covering more than 100 countries from 1960 to 1990. His empirical findings indicate that there exists a statistically significant negative relationship between inflation and economic growth if a certain number of the country characteristics (e.g., fertility rate, education, etc.) are held constant.

Bruno and Easterly (1995) examine the determinants of economic growth using annual CPI inflation of 26 countries which experienced inflation crises during the period between 1961 and 1992. In their empirical analysis, inflation rate of 40 percent and over is considered as the threshold level for an inflation crisis. They find inconsistent or somewhat inconclusive relationship between inflation and economic

growth below this threshold level when countries with high inflation crises are excluded from the sample.

Morgan and Katsilkeas, (1997) according to classical trade theory said that a country will export those goods and services in which it has an economic advantage while importing those goods that it does not have an economic advantage over. Boozer, et al. (2008) in an article explains the correlations between currency exchange rates and economic output in a country. Sangho, et al. (2010) took a study into 53 countries during 1991 to 2003 so as to estimate total factor productivity growth, and decompose it into technical efficiency change and technical progress. The empirical results indicate that world productivity growth was led by fast-growing newly emerging economies, whereas most developed countries experienced a decrease in productivity growth. Technical efficiency change significantly contributed to economic growth for many fast-growing countries, even though emerging economies still lag far behind developed countries in terms of technical efficiency.

METHODOLOGY

Econometrics is a branch of science which applies the tools of statistics and mathematics to analyze economic phenomenon. After formulating economics theory, econometric gives the numerical or qualitative expression to it. For the purpose of this research, we shall be taking a look at the Ordinary Least Square (OLS) method for estimating the parameters and also considering multi-collinearity, heteroskedasticity, and autocorrelation as the statistical tool in analyzing the economic phenomenon.

Multiple linear regression involves an extension of the regression model from the two variable model to the K-variable (K>2) model. This type of model

is determined by two or more independent variable. Assume that a linear relationship exists between a dependent variable Y and K independent variable then, the model is given by:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + e_i$$

Where:

$$i = 1, 2, \dots, n$$

Y = Dependent Variable

X₁...X_k = Explanatory / Independent variables

β₀...β_k = Parameters to be determined

e_i = Error or disturbance terms.

Testing for Significance of Regression Coefficients

The aim is to determine whether at least one of the independent variables contribute significantly to the model.

Given the model:

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_p \text{ then;}$$

$$H_0: \beta_i = 0$$

$$H_1: \beta_i \neq 0 \text{ for at least one } i$$

The test procedure requires:

$$F_0 = MSR / MSE \sim F_{\alpha, k-1, n-k}$$

Where MSR = Mean Square due to regression and MSE = Mean Square due to Error.

This procedure can be summarized using the analysis of variance table (Table 1).

Table 1: Analysis of Variance Table.

Source Of Variance	Degree Of Freedom	Sum of Squares	Mean Squares	F
Regression	k-1	$\beta \sum X Y - n \bar{Y}^2$	$\beta \sum X Y - n \bar{Y}^2 / (k-1)$	MSR/MSE
Error	n-k	$\sum Y Y - \beta \sum X Y$	$\sum Y Y - \beta \sum X Y / (n-k)$	
Total	n-1	$\sum Y Y - n \bar{Y}^2$		

Decision

Reject H_0 if $F_0 > F_{\alpha, K-1, n-K}$ and conclude that at least one of the explanatory variables contribute to the model.

MULTI-COLLINEARITY

One of the assumptions of this OLS technique is that there is no linear relationship between the explanatory variables (i.e., they are independent or $Cov(X_i, X_j) = 0$ for $i \neq j$) when this assumption fails then we've a problem of multi-collinearity. This will be tested using the Farrah Gluaber method to test for the presence and severity of multi-collinearity in a data.

This test involves three stages:

1. Chi Square: To determine existence and severity
2. F-test: Which variable are intercorrelated, if Chi Square is positive.
3. T-tests: Which variables are responsible for multi-collinearity, if F-test is positive?

HETEROSKEDASTICITY

The assumption that the variance of the disturbance term are constant (i.e., $E(U_i) = \sigma_i^2 \forall i$) must be valid when this assumption fails then we've a problem of heteroskedasticity. For this research work, we shall be using the Goldfield Quandt. This method is applicable when $T > 2k$ (i.e., the number of observation is twice the number of explanatory variable).

AUTOCORRELATION

Autocorrelation is said to occur when the assumption that for the estimability of parameter of the general linear regression equation $Y = X\beta + U$ (via the least square estimation the disturbance term U_i 's must be independent (i.e., $E(U_i, U_j) = 0$

$\forall i \neq j$) fails. Durbin Watson test will be employed to check for autocorrelation. It is given by:

$$DW = \frac{\sum_{t=2}^T (U_{t-2} - U_{t-1})^2}{\sum_{t=1}^T U_t^2}$$

Where DW = Durbin Watson statistic

U_t, U_{t-1} = Residual error for period t & t-1

$U_t = Y - \hat{Y}$

Where Y = Observed values

\hat{Y} = Expected values

DATA ANALYSIS AND INTERPRETATION

Using SPSS (Statistical Package for Social Science) for the analysis, the following results were obtained (Table 2).

The Durbin Watson statistic gives a value of 1.880, which indicates absence of autocorrelation in the data at 5% significance level. Since R-value is 0.987, there exists a very strong positive correlation between the predictors and the GDP. The correlation coefficient matrix reveals that chi squared value is $\chi^2 = 81.701$ which is greater than the critical value of $\chi^2(0.05, 6) = 12.59$. This indicates there is a need to reject the null hypothesis and conclude that there is multi-collinearity in the data. F-test which was employed to identify the variables which are intercorrelated exposed the fact that Oil, Agricultural Products, Machinery and Transport are each intercorrelated with other variables but Inflation Rate is not intercorrelated with other variables. Goldfield Quandt's Test gives us a F-value of 0.0218, so we accept the null hypothesis, since $F_{0.05}(4,4) = 6.39 > F_{\text{calculated}} = 0.0218$ and therefore conclude that the disturbance terms are homoscedastic.

Table 2: Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin Watson
1	.987	.974	.967	1.1433E6	1.880

Table 3: ANOVA Table.

Model	Sum of Squares	d.f.	Mean Square	F	Sig.
Regression	7.307E14	4	1.827E14	139.753	.000
Residual	1.961E13	15	1.307E12		
Total	7.503E14	19			

Table 4: Regression Coefficients.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	324072.893	585075.120		.554	.588
Oil	-2.109	7.743	-.103	-.272	.789
Agricultural Product	17.997	6.043	.531	2.978	.009
Machinery and Transport	8.953	3.988	.571	2.245	.040
Inflation Rate	-9364.295	13725.892	-.033	-.682	.505

When testing hypothesis about regression coefficient, the calculated F-value gives 139.785 which is greater than $F_{0.05}(4)(15) = 3.06$. We therefore reject the null hypothesis (H_0) and conclude that the independent variables (Oil, Agricultural products, Machinery and Transport and Inflation Rate) contributes significantly to the Gross Domestic Product (Y) which is the dependent variable.

$$\beta_1, t_{cal} = -0.272,$$

$$\beta_2, t_{cal} = 2.978,$$

$$\beta_3, t_{cal} = 2.245,$$

$$\beta_4, t_{cal} = -0.6822,$$

$$\text{and } t_{0.05}(15) = 2.131.$$

This shows that the independent variables (oil, agricultural products, machinery, transport, and inflation rate) jointly contributes to the Gross Domestic Product (GDP) but when tested individually, oil and inflation rate do not really contribute significantly to the GDP but agricultural products and machinery and transport have a significant contribution to the GDP.

From the analysis in Table 4:

$$GDP = \beta_0 + \beta_1(OIL) + \beta_2(AGR) + \beta_3(MAT) + \beta_4(INR) + U_t$$

Where:

GDP = Y = Gross Domestic Product

OIL = X_1 = Oil

AGR = X_2 = Agricultural Products

MAT = X_3 = Machinery and Transport

INR = X_4 = Inflation Rate.

Therefore:

$$GDP = 324072.893 - 2.109(OIL) + 17.997(AGR) + 8.953(MAT) - 9364.259(INF)$$

This can be interpreted as that each unit increase in the importation of oil will bring about a 2.109 units fall in the GDP when other variables are fixed. For a unit increase in agricultural products (AGR), we expect a 17.997 increase in the GDP keeping other variables fixed. A unit increase in machinery and transport (MAT) will bring about an 8.953 increase in the GDP with other predictors kept constant. A unit increase in the Inflation rate will bring about an alarming 9364.259 decrease in the GDP.

CONCLUSION

From the analysis, we can deduce that the effect of predictors is solely because Nigeria with her abundant natural resources still imports and pays international prices for natural resources she has

in abundance, due to mismanagement. There is no gain in saying that Nigeria relies so much on revenue from oil exports because the proceeds from exportation are used to import refined fuel for local consumption which can be greatly averted if proper measures are taken.

A 1% increase in the importation of agricultural products and machinery tends to affect the GDP positively. It is still advisable to encourage agriculture even on the homeland. Notably, in an open economy like Nigeria, which relies heavily on imports, a 1% increase in inflation rate will cause a fall in the GDP and this is inevitable because Nigeria depends on importation. Nigeria unavoidably faces the transmission of inflation being experienced by the country's trading partners. Given the relationship that exists between the inflation rate and oil and agriculture, these economic variables tend to move together.

RECOMMENDATION

On the strength of the findings in this study, the following policy suggestions are given for consideration by the relevant authorities. The government should endeavor to take a meaningful look at the various refineries located in the country. The nation's refineries' "Turn-Around-Maintenance" (TAM) should be consolidated with transparency and accountability. New refineries should also be built around the country. If existing refineries are functioning at full capacity, they can meet Nigeria's internal fuel needs and produce some excess for export. The government should pay more attention to agriculture by providing technical input and financial support. They should also pay attention to the non-oil sector of the economy. Local sourcing of materials for the productive sector should be embarked upon and supported by the concerned authorities.

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SUGGESTED CITATION

Babalola, B.T. and A.O. Olubiyi. 2012. "Econometric Analysis of Some Economic Indicators Influencing Nigeria's Economy". *Pacific Journal of Science and Technology*. 13(2):232-236.

 [Pacific Journal of Science and Technology](http://www.akamaiuniversity.us/PJST.htm)