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The Effect of Unemployment Rate and Population Growth Rate on Gross Domestic Product in Nigeria

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***Abstract* – This study applied the multiple regression model whose estimation co integrate the inverse relationship between unemployment rate and gross domestic product considering population growth as well. Thus, providing opportunity to assessing other determinants of economic growth, (in this case, population growth) to avoid limiting our economic assessment to unemployment rate as reflected in past research work and its inherent short-comings. The results estimated by the model developed in this research study revealed that since 1970, the rate of unemployment and population has been on the increase amidst declining gross domestic product. The result also reveal that unemployment and population growth contribute commeasurably to gross domestic product. Furthermore, the result showed that unemployment contributes more to the national gross domestic product during this period in line with existing work.**

***Keywords* – Multiple Regression, Unemployment, Population Growth, Gross Domestic Product.**

I. Introduction

Unemployment rate can either increase or decrease proportionately with respect to population growth or decline. Invariably, the increase in unemployment rate could be related to population growth especially in developing economies like Nigeria. Therefore, the need to checkmating unemployment rate to assuage its effects on Nigerian economy cannot be overemphasized.

The Central Bank of Nigeria [1] defined unemployment rate as the percentage of persons among the labour force (15-65 years) excluding students and those medically unfit available for work but do not find work. Gbosi [2] noted that the Nigeria's rising rate of unemployment portends great concern not only to the policy-makers, but the society as well, and that the rate at which population grows influences economic growth and consequently the Gross Domestic Product.

The rate of unemployment in Nigeria is unimaginably growing amidst alarming economic recession while population growth is on the increase. If not checked, this duo tyrant can pose devastating effects on the nation's future economy.

Currently, the insecurity plagues such as insurgency, public violence and societal crimes witnessed by the Nigerian economic are presumably products of unemployment in a growing population. This may be arguably true based on observations. Moreover, opinion polls suggest that the greater percentages of these perpetrators are unemployed, potential labour force.

To this end, the investigator's interest is to elucidate the effect of population growth rate and unemployment rate on Gross Domestic Product and by implication on Nigerian economy using "Regression Analysis" to ascertain the degree of relationship existing between gross domestic product and independent variables, (unemployment rate and population growth rate) as well as to measure the level of the dependency of gross domestic product on population growth rate and unemployment rate to buttress the initial assumption and hence establish the effect of unemployment rate and population growth rate on gross domestic product in Nigeria using appropriate test statistic using linear multiple regression.

II. Literature Review

Oduh et al, [3] alluded that one way of economizing efforts in any economy is to review and build up the work done by others. It is noteworthy to mention that the study cannot be isolated from economic theories and postulations.

He stated that Nigeria's informal economic still remains an enigma as it has neither been comprehensively studied nor understood. He observed that despite the wide range of informal sector economic processes and activities, current knowledge of the size, causes characteristics and dynamics of the informal sector remain very scanty and inadequate. He however admitted unemployment rate as one of the most important causes of the informal economy.

Although Odua[3] used the general multiple indictors multiple causes (MIMIC) model to estimate the size and determinant of the informal sector in Nigeria over the period 1970-2005 considering eleven state of the federation, however the model captures only the informal sector of the Nigerian economic and limited states. The MIMIC model also excluded the real GDP in its estimation thereby neglecting the most crucial aspect of the economy. He nevertheless noted in his research study that one growing fact about the measurement and the size of the informal sector is the methods and data availability which to a great context determines the level of accuracy. This study has the advantage of more data availability and most recent estimation techniques that will enhance appropriate prediction.

Okun [4]examined the relationship between the employment rate and the economic growth for the post-war years in the United State. In his estimation, he showed that 3% increase in the quarterly change in real GDP was associated with a one percentage point decrease in the rate of unemployment. Basically, the Okun's law states that if GDP grows rapidly the unemployment rate decline, if growth is very low or negative the unemployment rate remains unchanged. This is generally called Okun's law and it is unique since it is statistical and not just mere economic theory. In Okun's presentation, he defined the statistical relationship as:

$$\nabla U_t = a - b\nabla \log GDP_t \quad (1)$$

Where;

∇U_t is the change in unemployment rate over time, $\nabla \log GDP_t$ is the change in real GDP with time, 'a' is the intercept coefficient on the level above the national rate of unemployment and ' b' is the Okun's coefficient describing the elasticity of the unemployment rate with respect to GDP.

However, according to Patrick [5], Okun's law has held up reasonably well for the past two years - growth has been close to many estimates of potential GDP and the unemployment rate, on balance, has not decline much since the end of the last recession he observed.

Abel [6] contrary to Okun's estimate, observed a current version adjustment on the output gap-unemployment ration estimate to 2:1 for the united State. The real GDP Gap – unemployment ratio is presumably high for Nigeria owing to alarming rate of unemployment, nevertheless, it will still obey the Okun's law if estimated since Okun's coefficient provides room for such variation due to external factors. However their relationship is seen directly in the Okun's coefficient. However, the instability in this coefficient over time, region and business cycles has been subject of debate he noted.

Gordon [7] was of the opinion that a structural shift has been transforming the relationship before real GDP and unemployment since the 1980's, which could be as a result of several factors such as increase in income inequality, the surge of managerial power, the decline of union, the destruction of job product of low-cost products, competition with low skilled immigrants and the increase labour market flexibility in general. In addition, the Nigerian economic has been bedeviled by other factor such as preference of criminal activity to lawful labour, competition with high skilled expatriates and unavailability of job vacancies. According to him, the instability of the Okun's coefficient is traceable to delayed responses of the unemployment rate to change in GDP. A decline in the economic growth does not lead to an instantaneous increase in the unemployment rate due to existence of other intervening factors in this relationship such as rigid labour policies or uncertainty. However, he omitted population growth in his considerations which may possibly be presumed as one among the uncertainties.

Patrick [5] developed a simple model based on the analysis of economist Robert Gordon and others, relating GDP growth to its consistent labour market-side components (such as productivity growth, average hours worked, labour force participation and the unemployment rate). It builds in the consequences of production aging on labour force participation in much the same way the CBO does. The model forecasted an unemployment rate of 8.6 percent in the fourth quarter of 2012 which was almost identical to the actual consensus "Blue Chips" unemployment projection. In response to other estimations, he concluded in his paper that a lot depend on productivity and labour force participation trends which are very difficult to forecast.

Knotek [8] argued that if the instability of the Okun's law is taken into consideration, this relationship contributes a useful forecasting tool. It was observed that after the 2008 financial crisis (global recession), the Okun's coefficient was drastically disrupted in some developed countries. However, scholars accredited this behaviour to social, technological and normative transformations over a time period. It is also observed that the Okun's coefficient unresponsiveness of unemployment to GDP relative to different countries is due to intensive flexibilization, technological change, immigration and government policies etc. Therefore, scholar in field of study are yet to understand the variability of the coefficient and have argued that this coefficient varies due to technological change and social infrastructure which differs from one country to the other.

Keynesian employment theory [9] in contrast to the classical position posit that capitalism simply does not contain any mechanism capable of guaranteeing full employment. He further explained that economic fluctuations should not be associated exclusively with external forces such as wars, drought and similar abnormalities. Rather, the causes of unemployment and inflation i.e. considerable degree of the failure of certain fundamental economic decision particularly saving and investment decision. These factors boost the Gross Domestic Product of an economic.

Obadan and Odusola, [10]observed that unemployment growth are inversely related in Nigeria based on research study conducted on various sectors of the Nigerian economic. They noted that growth responds to unemployment variedly among different sectors of the economic. The research study was however restricted to causal links between unemployment and productivity in different economic sectors excluding service sectors. As a result the research cannot be generalized with respect to Okun's law due the myopic view that did not capture the generality of unemployment rate of the entire labour force of the Nigeria population.

The 2015 book of labour statistics [11] reported that unemployment rate has generally risen during the world wide recession of the 1980s and 1890s. The rational step taken by most management to cope with recession includes ban on recruitment which further increases the unemployment rate. Since graduate are mostly first job seeker, this practices of natural wastage, which involves the refusal to fill vacancies imply that graduate are directly hit, he noted.

Godfrey [12], noted that one of the measure adopted by government in developing countries as part of their policies package to solve manpower problem is establishment of National Youth Services Programmes. The NYSC in Nigeria came into being in 1973 in response to the particular urgent needs of fostering national unity, a measure of recouping government investment in graduate. Unfortunately, the NYSC scheme has encourage employer (private and public) to shy away from employing graduates thereby contributing to graduate unemployment in Nigeria.

Downess et al [13], in his quest to investigate the necessary condition for reducing the unemployment rate in Trinidad and Tobago within the period established by OLS instrumental variables.In his discoveries, he observed that both long and short run change in real GDP and real average earning have a statistical impact on changes in unemployment rate in consonance to Okun's inverse relationship.

III. Sources and Method of Data Collections

The data used in this research study are secondary data sourced from three national institutions namely National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) and Nigeria Population Commission (NPC) as presented in appendix A and B. These data were sourced on-line as posted in their various website databases. The data are detailed records on population growth rate, unemployment rate and Gross Domestic product of Nigeria over a period of 41 years precisely, 1970-2010.Data available within this 41 years period were sourced and will be used to analyze the effect of unemployment in Nigeria economy as stated in Okun's law.

The data will be analyzed using "regression analysis".

IV. Methodology

Knowledge of the relationship among variables often leads to methods for predicting the value of one quantity by using values of related quantities. Such knowledge may also guide us in controlling the value of one variable by adjusting the values of related variables. Regression analysis provides us a powerful and plausible approach for examining associations among variables hence obtaining good rules for prediction. Regression analysis is a mathematical measure of the average relationship between two or more variables in terms of the original units of data". Before equation of the best line can be determined, some criterion must be established as to what conditions the best line should satisfy.

Specifically, the researcher's investigation will conduct an analysis on the "Effects of Unemployment Rate (UPR_t) and Population Growth Rate (PGR_t) on Gross Domestic Product (GDP_t) (1970-2010), using regression techniques. In this investigation, the researcher will employ two commonly used regression techniques: multivariate and multiple regressions respectively to estimate the model:

$$GDPt = \beta_0 + \beta_1 \text{ UPRt } + \beta_2 + \text{ PGRt } + \varepsilon_t \quad . \qquad (2)$$

However, for convenience, we shall adopt the conventional use of

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + e_i \qquad (3)$$

4.1 Model Formulation

Generally, the three variable population regression formulation (PRF) is given by

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + U_i \qquad (4)$$

Where Y is the dependent variable, X_1 and X_2 the explanatory variables (or regressor), U is the stochastic disturbance term, β_0 is the intercept term and β_1, β_2 are called the partial regression coefficients.

To estimate the parameters of the three variable regression model using the OLS, we consider the sample regression formation (SRF) defined by (4) and deduces that

$$R^2 = \frac{ESS}{TSS} = \frac{\text{explained sum of squares}}{\text{total sum of sqaures}} = 1 - \frac{RSS}{TSS},$$

such that $R = \pm\sqrt{\frac{ESS}{TSS}}$

$$\bar{R}^2 = 1 - \left(\frac{\sum e_i^2 / (N-k)}{\sum y_i^2 (N-1)} \right) \qquad (5)$$

$$\bar{R}^2 = 1 - \frac{\hat{\sigma}^2}{S_y^2} = 1 - \left((1-R^2)\frac{N-1}{N-k} \right) \qquad (6)$$

where S_y^2 is the pooled variance

In particularly since we have two independent variables, (UPR_t and PGR_t), the population regression function GDP_t on UPR_t and PGR_t is of the form:

$$\mu_{GDPt}(\text{UPRt, PGRt}) = \beta_0 + \beta_1 \text{ UPR}_t + \beta_2 \text{ PGR}_t \qquad (7)$$

Represented diagrammatically, we have:

Table 1: Systematic Display of the Target Population Regression Function(1972-2010).

Items (Period)	Gross Domestic Product(GDP_t)	Unemployment Rate(UPR_t)	Population Growth Rate(PGR_t)
1970	Y_1	X_{11}	X_{12}
1971	Y_2	X_{21}	X_{22}
1972	Y_3	X_{31}	X_{32}
: :	: :	: :	: :
2010	Y_n	X_{n1}	X_{n2}

Where GDP_t is the dependent variable.

Alternatively, the data can also be analyzed using the multivariate analysis as a regression tool. This is plausible since the assumptions in multivariate regression are analogous to those of multiple regressions.

In this context, we shall assume X_s as fixed in the model. In fixed X-regression model we express each Y in a sample of n-observations as a linear function of the X_s.

4.2 Hypothesis Testing and Assumptions

Hypothesis (a)

Consider a 3 variables regression model defined by

$$Y_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + \varepsilon_i$$

To test for overall significance of the population regression assuming that Y_i □ N (0, σ^2), then,

H_o: $\beta_1 = \beta_2 = 0$ (*i.e* all slope coefficient are simultaneously zero);

vs

H_1: $\beta_1 \neq \beta_2 \neq 0$ (i.e not all slope coefficient are simultaneously zero).

Test Statistic (a):

We can use: (i) F – test statistic. (ii) t-student statistic and (iii) z-test statistic as follows:

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(i) $F = \frac{ESS/df}{RSS/df} = \frac{ESS/(K-1)}{RSS/(N-K)} = \frac{R^2/(K-1)}{(1-R^2)/(N-K)}$ (8)

Where F~ F_α (K – 1, N – K); k = 3, $F_\alpha,(k-1, N-k)$; $n \geq 30$

If F $> F_\alpha,(k-1, N-k)$; reject H_o and accept otherwise where $F_\alpha,(k-1, N-k)$; is the critical F – value at $\propto$ level of significance.

Hypothesis (b)

Thehypothesis testing for the overall multivariate regression using the T –test, we assume that Y ~ N (Xβ, σ^2 I) ∋ H_o: $\beta_1 = \beta_2 = 0$ vs H_1: $\beta_1 \neq \beta_2 \neq 0$

Test Statistic

$$F = \frac{SSR/k}{SSE/(n-k-1)} \sim F_\alpha,(k, n-k-1) \quad (9)$$

We reject H_o if F > $F_\alpha,(k, n-k-1)$, accept otherwise.

Also, the hypothesis testing about individual partial regression coefficient:

H_o: $\beta_1 = 0$ vs H_1 : $\beta_1 \neq 0$ and H_0 : $\beta_2 = 0$ vs $\beta_2 \neq 0$

Where the test statistic is given

$$F = \frac{\hat{\beta}'X'Y - \hat{\beta}_r'X_r'Y}{SSE_f/(n-k-1).} \sim F_\alpha h, n-k-1;\ h = 1$$

Where

$SSE_f = Y'Y - \hat{\beta}'X'Y$ and $SSE_r - SSE_r = \hat{\beta}'X'Y - \hat{\beta}_r'X_r'Y$

T = $\frac{\hat{\beta}_j}{S\sqrt{g_{jj}}}$ where g_{jj} is the diagonal element of $(X'X)^{-1}$ and S = $\sqrt{SSE_f/(n\text{-}k\text{-}1)}$

And

$$F = \frac{n-k-1}{k}\left[\frac{R^2}{1-R^2}\right]. ;\ R^2 = \frac{S_{yx}'\sigma^{-1}{}_{xx}S_{yx}}{S_{yy}} = r_{yx}'R_{xx}^{-1}r_{yx} \quad (10)$$

And S^2, is a biased estimator of σ^2. that is,

E(S) = E [$\sum(x_j - \bar{x})'(x_j - \bar{x})$]

The Test Statistics is

$$T^2 = (\bar{x} - \mu_0)'\frac{S^{-1}}{n}(\bar{x} - \mu_0)$$

$$= n(\bar{x} - \mu_0)'S^{-1}(\bar{x} - \mu_0); \quad \bar{x} = \frac{1}{n}\sum_{j=1}^{n} x_j \quad (11)$$

Where $\mu_0 = \begin{bmatrix} \mu_{10} \\ \mu_{20} \\ : \\ : \\ \mu_{ko} \end{bmatrix} = \begin{bmatrix} \mu_{10} \\ \mu_{20} \\ \mu_{30} \end{bmatrix}$; p = 3

The above test statistics in equation (3) is called the Hotelling T^2 in honour of Harold Hotellings a pioneer in multivariate analysis. Here S/n is the estimate covariance matrix of $\bar{X}$. If T^2 is too large, we use

$$T^2 = \frac{(n-1)k}{n-k} F_\alpha, k, n-k. \quad (12)$$

∋ H_o: $\mu = \mu_0$ vs H_1:, H_0 $\mu \neq \mu_0$

Therefore, in this case, we employ

$$T^2 = [n(\bar{x} - \mu_0)'S^{-1}(\bar{x} - \mu_0)] > \frac{(n-1)k}{n-k} F_\alpha, k, n-k$$

If $T^2 > \frac{(n-1)k}{n-k} F_\alpha, k, n-k$; we reject H_0: accept otherwise at α - level of significance.

4.2.1 Confidence Interval (C.I)

Recall that, for a normal distribution;

$$Z = \frac{\hat{\beta}_i - \beta_i}{\sigma\hat{\beta}_i} \sim N(0,1);\ n \geq 30$$

Therefore confidence interval (C.I) for 100 (1-α) % is defined by:

$P_r\left[-Z_{\alpha/2} < Z < Z_{\alpha/2}\right] = 1 - \alpha$. then $\hat{\beta}_i \pm Z_{\alpha/2}\ \sigma\hat{\beta}_i$

Similarly, the confidence interval for 100 (1-□) % is defined by: $\hat{\beta}_i \pm t_{\alpha/2} S_e(\hat{\beta}_i)$ since

$$t = \frac{\hat{\beta}_i - \beta_i}{S_e(\hat{\beta}_i)} \sim t\ \alpha, (n\text{-}k);\ n < 30$$

V. Data Analysis

Using the sourced data presented in table 8 and 9, the parameters (β_0 , β_1 and β_2) can be estimated using the above formulae but computer software called SPSS package will be used for the analysis. Details of analysis are shown below:

Following the SPSS package computation and manual calculations as evaluated with their respective formulae defined in (1) –(11), the result of the respective characteristics of the population, mean ($\bar{X}$), variance (σ^2) and standard deviation (σ), are as shown in 2.

Similarly, the multiple regression coefficient of determination (R^2), coefficients of correlation R and the adjusted Ŕ^2 are 0.034, 0.184$_e$ and -0.017 respectively as shown in table 4.

From the analysis conducted as described above, the estimate of the coefficient (i.e parameters β_0, β_1 and β_2), the sum of squares regression (SSr), the residual sum of squares (RSS) and the total sum of squares (TSS) are as shown in table 5-6. The mean square regression (MSr) and mean squares residual (MSR) are as shown in table 5-6.

Conclusively, the F –statistics values, ANOVA values and the t- Statistics values with their various level of significance are as shown in table 5 and table 6.

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5.1 Regression Analysisusing Spss Software On Target Population (1970-2010)

Table 2: Descriptive Statistics Showing Characteristics Of The Population For N-Observation

	N	Sum	Mean	Std. Deviation	Variance
(GDPt)	41	1053.00	25.6829	26.67999	711.822
(UPRt)	41	290.00	7.0732	5.34972	28.620
(PGR)	41	125.50	3.0610	.37207	.138
Valid N	41				

Table 3: Correlations

VARIABLES		(GDPt)	(UPRt)	(PGRt)
Pearson Correlation	GROSS DOMESTIC PRODUCT (GDPt)	1.000	.096	.184
	UNEMPLOYMENT RATE (UPRt)	.096	1.000	.609
	POPULATION GROWTH RATE(PGRt)	.184	.609	1.000
Sig. (1-tailed)	GROSS DOMESTIC PRODUCT (GDPt)	.	.276	.125
	UNEMPLOYMENT RATE (UPRt)	.276	.	.000
	POPULATION GROWTH RATE(PGRt)	.125	.000	.
N	GROSS DOMESTIC PRODUCT (GDPt)	41	41	41
	UNEMPLOYMENT RATE (UPRt)	41	41	41
	POPULATION GROWTH RATE(PGRt)	41	41	41

Table 4: Model Summary Of Multiple Linear Regression Analysis Indicating Overall Effect Of UPRt and PGRt ON GDPt using F-Statistic

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2Change	F Change	df1	df2	Sig. F Change
1	.185[a]	.034	-.017	26.90208	.034	.671	2	38	.517

a. Predictors: POPULATION GROWTH RATE(PGR), UNEMPLOYMENT RATE (UPRt)
b. Dependent Variable: GROSS DOMESTIC PRODUCT (GDPt)

Table 5: Summary of Analysis using Anova in Testing the Effect of UPRt and PGRt on GDPt

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	971.448	2	485.724	.671	.517[b]
	Residual	27501.430	38	723.722		
	Total	28472.878	40			

a. Dependent Variable: GROSS DOMESTIC PRODUCT (GDPt)
b. Predictors: POPULATION GROWTH RATE(PGRt), UNEMPLOYMENT RATE (UPRt)

Table 6: Summary on Analysis using T-Statistic to Test for Partial Relationship between (UPRt and PGRt) on DPt

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-17.153	40.426		-.424	.674
	UNEMPLOYMENT RATE (UPRt)	-.129	1.003	-.026	-.128	.898
	POPULATION GROWTH RATE(PGR)	14.292	14.418	.199	.991	.328

a. Dependent Variable: GROSS DOMESTIC PRODUCT (GDPt)

5.2: Test For Normality and C.I

Recall that

$$Z = \frac{\hat{\beta}_i - \beta_i}{\sigma\hat{\beta}_i} \sim N(0,1);\ n \geq 30$$

For unemployment rate, $Z = \frac{-0.129-(-0.026)}{1.003} = -0.1027$

=> 0.4483 (from Normal table).

The C.I. at 95 percent is given by $\hat{\beta}_i \pm z_{\alpha/2}\, \sigma\hat{\beta}_i$

=> -0.129 ± 1.003 (1.96) = -0.129 ± 1.9659

=> C.I =[-2.0949, 1.8369].

That is, we have 95 percent confidence that the true unemployment population parameter, β lies between [-2.0949, 1.8369].

For population growth rate,

$Z = \frac{14.292-0.199}{14.418} = 0.9775$, => z = 0.8340

C.I at 95 percent => 14.292 ± 14.418(1.96),

=> 14.292 ± 28.2693

∴ C.I = [-13.9773, 42.5613]

We are 95 percent confident that the true population parameter for population growth rate, β_2 lies between [-13.9773, 42.5613].

To determine if the target population mean (μ_o) is a plausible value for a mean vector of a multivariate normal distribution; we use equation (9) - (11).

By table 4, $\bar{X} = \begin{bmatrix} 25.6829 \\ 7.0732 \\ 3.0610 \end{bmatrix}$; And the estimated variance from table 3.2.4 column 4 = 723.722 where n = 41. Therefore $= \frac{41(723.722)}{40} = 741.8151 \Rightarrow S^{-1} = \frac{1}{741.8151}$

To test the hypothesis;

H_o: μ = [25,7, 3] vs H_1: μ ≠ [25,7, 3]; we have:

$$T^2 = 41[0.6829, 0.0732, 0.0610]\frac{1}{741.8151}\begin{bmatrix} 25.6829 \\ 7.0732 \\ 3.0610 \end{bmatrix} = 0.0263$$

Therefore, $T^2_{Cal} = 0.0263$But, $T^2 \sim \frac{(n-1)k}{n-k} F_\alpha, k, n-k$

At $\alpha = 0.05$;T^2_{tab} = 3.1579 ($F_{0.05}$, 3, 38) = 3.1579 (2.92) = 9.2211

Decision Rule

$$T^2_{Cal} = 0.0263 < T^2_{tab} = 9.2211$$

Therefore, we accept H_0 and conclude that the component mean or some combination of means do not differ too much from the hypothesized mean value [25, 7, 3].

5.3 Test For Equality Of Regression Model

H_o: The regression models are not equal vs H_1: The regression models are equal.

Test Statistic:

$$F_{cal} = \frac{MSE\ pooled}{MSE} \sim F_\alpha(K-1), (n_1 - k) + (n_2 - k) \equiv F_\alpha, v_1, v_2.$$

But from table5 and table 6, the corresponding MSE is 705.847 + 688.928 = 1394.775.

Therefore, the residual squares difference is $\sum e^2 pooled - [\sum e_1^2 + \sum e_2^2]$
= 27501.430 – [27528.029 + 26868.175]

= -26894.774

⇨ MSE = $\frac{SSE}{K-1} = -26894.774$;

(K= no. of individual regression model = 2)

From table 5

MSE_{pooled} = 723.722.$F_{cal} = \frac{723.722}{-26894.774} = -0.0269$

At 95 percent level of significance;F_{cal} = $F_{00.5}$, 2, 76 = 3.15

Decision Rule:

Reject the null hypothesis (H_0) if $F_{cal} > F_{tab}$, accept otherwise.

Since F_{cal} = 0.0269 <F_{tab} = 3.15 at 95 percent level of significance, we accept H_0 and conclude that the regression model are not equal. Moreover, the residual difference provides a measure of how adequate a single model fits all the data than the two individual models fits the data, as reflected in the negative value obtained for the mean residual square difference.

5.4 Interpretation

Table 3shows the mutual inter-relationship between the variables. It is observed from the table that the relationship between the dependent variable, (GDPt) and independent variables is relatively weak.

Table 4shows that the coefficient of determination, R^2 is often used to judge the adequacy of regression model to the target population value where 0< R^2<1. The R^2 indicates that 3.4 percent of the total variation is accounted for the regression model while 96% is due to error arising from other factors. This explains why the significant F-value is greater than 0.05 indicating negligible effect of unemployment and population growth on gross domestic product in Nigeria within the period under review. Also, the R = 0.185 shows a negligible effect of unemployment and population growth on GDP in Nigeria during this period.

Table 5 which is the ANOVA table indicates overall negligible effects on population growth and unemployment rate with this period in Nigeria.

Table 6 describes the model indicating the contributing effects of population growth rate and unemployment rate. Particularly it shows that an increase in the rate of unemployment and population growth will yield a corresponding decrease in Gross Domestic Product and vis versa. That is, it reflects the inverse relationship between unemployment rate and GDP as postulated by Okun's law. Furthermore, the t-statistic value shown in table 6and its corresponding significant value indicate the partial effect of the coefficient estimates.

In addition, the individual regression analysis of gross domestic product on each independent variable (population growth rate and unemployment rate) conducted using the SPSS shows that population growth rate contributes about 3.2 percent to national gross domestic product during this period as shown in model summary (table 7, appendix B). Similarly, the model summary (table8, Appendix B) reveals that unemployment rate only contributes 0.8 percent to the national GDP during the period under study. In general, the analysis conducted on sourced data during this period suggests that the Nigerian population growth rate influences the national gross domestic product than the unemployed labor force during the period (1970 – 2010) in Nigeria.

VI. Summary

Okun's [4] developed a model defined below which describes the relationship between unemployment and gross domestic product. The model established his postulation with the Okun's coefficient describing the variation across country due to other contributing factors previously stated. Basically, the concept of unemployment and population growth is a major phenomenon in all climes which has aroused the interest of academians and professional fields.

Conclusively, the overall test reflects the inverse relationship between the dependent variable, (GDP_t) and the independent variable, (UPR_t and PGR_t) as described by the estimated model:

$$G\bar{D}Pt = \hat{\beta}_0 + \hat{\beta}_1\ U\bar{P}R_t + \hat{\beta}_2\ P\bar{G}R_t\ .$$

From table 6, the estimated values of the parameters including the intercept parameters, will give:

$$G\bar{D}Pt = -17.153 - 0.129\ G\bar{P}R_t + 14.292\ P\bar{G}R_t\ .$$

However, due to level of significance as shown in table 4 and 6 showed that the overall effect of the independent variable (UPR_t and PGR_t) on the dependent variable (GDP_t) is considerably negligible. Notwithstanding, the effect cannot be overemphasized as it contributes 3.4 percent of the GDP during the period under review (i.e, 1970-2010).

Moreover, the negative value of the OLS estimator of the population intercept over this period indicates that neglect of this determinant will yield depreciating effect on the national gross domestic product.

Conclusively the test for adequacy (fitness of model) of the multiple regression model indicated that the model is inadequate. This is account for by very low coefficient of determination (i.e R^2 = 0.03.4) which depicts that the independent variables (UPR_t and PGR_t) contributes insignificantly to GDP_t which is not true. This discrepancy is presumably traceable to limitation encountered in the use of secondary data. However, measure could be adopted to correct this unexpected result. That is, by reducing the population size amongst others**.**

VII. Conclusion

The result of the analysis indicated that there is a systematic relationship between gross domestic product with respect to population growth and unemployment rate. Furthermore, the empirical analysis estimates of the regression model conducted on data obtained from national Bureau of statistics bulletin [14], Central Bank of Nigeria,[15]) and a publication “Population Growth and Policies in Sub-Sahara Africa” reveals that negligence on the impact of population growth and unemployment rate contributes 3.4 percent of the National gross domestic product in Nigeria during the period (1970-2010) in review.

Specifically, the result further shows that unemployment rate has an inverse relationship on gross domestic product in tandem with Okun’s law (1962). That is, the study shows that unemployment rate account for about 12.9 percent decrease of the national gross domestic product. In the same vain, population growth rate account for negligible or no negative effect on the gross domestic products. This is due to non-involvement of the large percentage of the labour force and the non-labour force in the economic sector owing to ranking unemployment rate in Nigeria.

Finally, the estimate from the analysis on the target population indicates that there is an inverse relationship between the dependent variable, (GDP) and the independent variables (UPR and PGR). That is, increase in GDP will cause a corresponding decrease in UPR and PGR. However, the population data shows that the overall effects of population growth and unemployment rate is negligible since it only contributes 3.4 percent to the Nigeria economic during this period. That is, the significant level using the F-statistic, t-statistic and ANOVA results are respectively greater than 0.05 as details in table 1 to 6 respectively.

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APPENDIX A

Table 7: Systematic Representation on Target Population (1970-2010)

PERIOD (YEAR)	GROSS DOMESTIC PRODUCT (GDPt)	UNEMPLOYMENT RATE (UPRt)%	RATE POPULATION (PGRt)%
1970	5, 281. 10	3.10	2.50
1971	6,650.90	4.90	2.50
1972	7,187.50	2.00	2.50
1973	8,630.50	3.20	2.70
1974	18,823.10	6.20	2.70
1975	21,475.24	4.10	2.70
1976	26,665.78	4.30	2.70
1977	31,520.34	2.10	2.70
1978	34,540.10	1.60	2.70
1979	41,974.70	2.00	2.70
1980	49,632.32	1.90	2.50
1981	47,619.66	4.10	2.50
1982	49,069.28	4.20	2.50
1983	53,107.38	5.30	2.50
1984	59,622.53	7.90	2.70
1985	67,908.55	6.10	3.10
1986	69,146.99	5.30	3.10
1987	105,222.84	7.00	3.10
1988	139,085.30	5.10	3.10
1989	216,797.54	4.10	3.10
1990	267.549.99	3.50	3.30
1991	312,139.74	3.10	3.30
1992	532,613.83	3.50	3.30
1993	683,869.79	3.40	3.30
1994	899,863.22	3.20	3.30
1995	1,933,211.55	1.90	3.30
1996	2,702,719.13	2.80	3.30
1997	2,801,972.58	3.40	3.30
1998	2,708,430.86	3.50	3.30
1999	3,194,014.97	17.50	3.30
2000	4,582,127.29	18.10	3.30
2001	4,725,086.00	13.70	3.30
2002	6,912,381.25	12.20	3.30
2003	8,487,031.57	14.80	3.50
2004	11,411,066.91	11.80	3.50
2005	14,572,239.12	11.90	3.50
2006	18,564,594.73	13.40	3.50
2007	20,657,317.67	14.60	3.50
2008	24,296,329.29	15.90	3.50
2009	24,794,238.66	16.30	3.50
2010	29,205,782.96	17.20	3.50

SOURCE: CBN (2011) STATISTICS BULLETIN, NBS (2011) STATISTICS BULLETIN,

Table 8: Population Growth and Policy in Sub-Sahara, Africa

PERIOD (YEAR)	GROSS DOMESTIC PRODUCT (GDPt)%	UNEMPLOYMENT RATE (UPRt)%	RATE POPULATION (PGRt)%
1970	11.00	3.10	2.50
1971	25.00	4.90	2.50
1972	8.00	2.00	2.50
1973	20.00	3.20	2.70
1974	118.00	6.20	2.70
1975	14.00	4.10	2.70
1976	24.00	4.30	2.70
1977	18.00	2.10	2.70
1978	10.00	1.60	2.70
1979	22.00	2.00	2.70
1980	18.00	1.90	2.50
1981	-4.00	4.10	2.50
1982	3.00	4.20	2.50
1983	8.00	5.30	2.50
1984	12.00	7.90	2.70
1985	14.00	6.10	3.10
1986	2.00	5.30	3.10
1987	52.00	7.00	3.10
1988	32.00	5.10	3.10
1989	56.00	4.10	3.10
1990	23.00	3.50	3.30
1991	17.00	3.10	3.30
1992	71.00	3.50	3.30
1993	28.00	3.40	3.30
1994	32.00	3.20	3.30
1995	15.00	1.90	3.30
1996	40.00	2.80	3.30
1997	4.00	3.40	3.30
1998	-3.00	3.50	3.30
1999	18.00	17.50	3.30
2000	44.00	18.10	3.30
2001	3.00	13.70	3.30
2002	46.00	12.20	3.30
2003	23.00	14.80	3.50
2004	35.00	11.80	3.50
2005	118.00	11.90	3.50
2006	27.00	13.40	3.50
2007	11.00	14.60	3.50
2008	18.00	15.90	3.50
2009	2.00	16.30	3.50
2010	18.00	17.20	3.50