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Modelling the Effect of Gross Domestic Product (GDP) Per Capita on Population Growth, Youth Unemployment and Net Migration.

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Abstract
This work modelled the effect of gross domestic product per capita on population growth, youth unemployment and Net Migration for a period of 20years. The data that is used in this research is a secondary data and it consist of annual observations of GDP per capita, population growth, youth unemployment rate and net migration rate for a period of 20 years. The data was collected from two major sources, Federal Reserve Economic Data (https://fred.st.louisFed.org) and United Nations World-Population prospects (https://macrotrends.net>NGA) and the data ranges from the period of 2000 to 2019. A multiple linear regression technique was applied with the use of SPSS software. Four different models were fitted, their parameters estimated and their significant effects examined using analysis of variance techniques. The model adequacies were tested and prediction was made with the most adequate model having an R^2 of 89%. The result showed that gross domestic product per capita on population growth, youth unemployment and net migration was statistically significant. The simple linear regression for gross domestic product per capita on population growth and net migration were also significant with p-values less than 0.05 while gross domestic product per capita on youth unemployment was not statistically significant with a p-value above 0.05. The result further led to the rejection of the null hypothesis which claims that gross domestic product per capita on population growth, youth unemployment and net migration was not statistically significant, hence we conclude that multiple linear regression of Nigeria gross domestic product per capita on population growth, youth unemployment and net migration rate was statistically significant.

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I. Introduction

The influence/impact of Nigeria's Gross Domestic Product (GDP) per capita on the population growth, youth unemployment rate and net migration rate cannot be over emphasized, it has been discovered that the aforementioned independent variables (population growth, net migration rate and youth unemployment rate) would have significant effects on the dependent variable (GDP per capita) either positively or negatively. Piketty (2014) in his work established that Economic growth is measured by changes in country's Gross Domestic Product (GDP) which can be decomposed into its population and economic elements by writing it as population times Per Capita GDP. GDP is a measure of economic output and it is also an indicator of national income which can be defined as the total output not of capital depreciation plus net income from sources outside the country.

According to International Labour Organization (ILO) defined the unemployment as numbers of the economically active population, who are without work but available and seeking for work including people who have lost their job and those who have voluntarily left work. Unemployment has been defined as a situation where people who are willing and capable of working are unable to find a suitable paid employment, Ekezie et al (2013), Fajana (2000). He further stated that, the higher the rate of unemployment in an economy, the higher the level of poverty and associated welfare challenges. According to National Bureau of Statistics (2012), Nigeria;s rate of unemployment stand at 19.7%.

Net migration rate is one the factors that could either have negative or positive or no significant effect on the economic well-being of Nigeria which is GDP per capita. Net migration rate include the estimate for the difference between the number of persons entering and leaving a country during the year per 1000 persons (based on midyear population).When the analysis involves just the dependent variable and one independent variable we call it simple linear regression, whereas if the analysis involves one dependent variable and two or more independent variables we called it multiple linear regression.Adenomon (2016) modelled the relationship between GDP and agriculture using data from 1960 to 2014. The ADF test revealed that agriculture and GDP variables are stationary at first difference, Mbachu et al (2012), Nwanya et al (2019). The evidence from bound testing and Johansen cointegration test revealed that agriculture and GDP variables are not cointegrated. Lastly, evidence from first difference revealed that 1% increase in the change of agriculture leads to about 90.86% increase in the change of GDP. Olajide et al. (2012) investigated the interrelationship between GDP and agricultural output in Nigeria. Their work revealed that there exists a positive and significant effect between agriculture and GDP in Nigeria.Adenomon and Oyejola (2013) examined the impact of agricultural and industrial sectors on GDP in Nigeria from 1960 to 2011 and their result showed that agriculture contributed about 50% to GDP while industrial sector contributed 32% to GDP in Nigeria.

Gibbs et al (2006) examined the relationship between home environment factors and reading achievement in Zimbabwe. The study utilised data collected by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) using linear regression analysis through structural equation modelling using AMOS 4.0. The results showed that a proxy for SES was the strongest predictor of reading achievement. Zimbabwe, reading achievement, home environment, linear regression and structural equation modeling.

II. Method

2.1 Multiple Linear Regression Model:

The multiple linear regression model can be stated as;

$$Y = \beta_0 + \beta_1 X_1 + \ldots + \beta_p X_p + e \qquad \text{(a)}$$

If we have set of n observations, then every set of observations satisfies model (a) and we can write

$$y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12} + \cdots + \beta_p x_{1p} + e_1$$
$$y_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \cdots + \beta_p x_{2p} + e_2$$
$$\vdots \qquad\qquad \vdots \qquad\qquad \vdots$$
$$y_n = \beta_0 + \beta_1 x_{n1} + \beta_2 x_{n2} + \cdots + \beta_p x_{np} + e_n \qquad \text{(b)}$$

It is possible to write the ***n*** equations in (b) in matrix notation as

$$\underline{y} = \underline{X\beta} + \underline{e} \qquad \text{(c)}$$

Where $\underline{y} = \begin{pmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_n \end{pmatrix}$, $\underline{X} = \begin{pmatrix} 1 & x_{11} & x_{12} & .. & x_{1p} \\ 1 & x_{21} & x_{22} & .. & x_{2p} \\ . & . & . & . & . \\ . & . & . & . & . \\ 1 & x_{n1} & x_{n2} & .. & x_{np} \end{pmatrix}$, $\underline{\beta} = \begin{pmatrix} \beta_0 \\ \beta_1 \\ . \\ . \\ . \\ \beta_p \end{pmatrix}$, $\underline{e} = \begin{pmatrix} e_0 \\ e_1 \\ . \\ . \\ . \\ e_n \end{pmatrix}$

The letters y, X, β, e are refer to as vectors and matrices rather than scalars. The capital letter X makes it clear that X is a matrix of order n x p representing n observations on each of the covariates $X_1, X_2, \ldots, X_p$. similarly, y is a n x 1 vector of n observation on Y, β is a p x 1 vector of regression coefficients associated with $X_1, X_2, \ldots, X_p$ and $\boldsymbol{e}$ is a n x 1 vector of n errors. The matrix X is called a design matrix and contains both a column of 1's denoting the presence of intercept term and all the explanatory variable which are relevant to the linear model.

The errors **e** reflects the deviations of the observations from the regression line and therefore, the difference between the observed and fitted relationships.

2.2 Estimation of Model Parameters: the method of the least square can be used to estimate the regression coefficients. Here it is assumed that the error term $\boldsymbol{e}$ in the model has $E(\boldsymbol{e}) = 0$, $Var(\boldsymbol{e}) = \sigma^2$, and that the errors are uncorrelated. We may write simple linear regression corresponding to equation (a) as $Y_i = \beta_0 + \beta_1 X_{i1} + \ldots + \beta_p X_{ip} + e_i = \beta_0 + \sum_{j=1}^{p} \beta_j X_{ij} + e_i,\ i = 1,2, \ldots, n$ the least square function is $S(\beta_0, \beta_1, \ldots, \beta_p) = \sum_{i=1}^{n} e_i^2 =$

$$\sum_{i=1}^{n} \left(Y_i - \beta_0 - \sum_{j=1}^{p} \beta_j X_{ij}\right)^2 \qquad \text{(d)}$$

The function S must be minimized with respect to $\beta_0, \beta_1, \ldots, \beta_p$. The least square estimators of $\beta_0, \beta_1, \ldots, \beta_p$ must satisfy $\left.\frac{\partial S}{\partial \beta_0}\right|_{\hat{\beta}_0, \hat{\beta}_1, \ldots, \hat{\beta}_p} = -2 \sum_{i=1}^{n} \left(Y_i - \beta_0 - \sum_{j=1}^{p} \beta_j X_{ij}\right) = 0$

And $\left.\frac{\partial S}{\partial \beta_j}\right|_{\hat{\beta}_0, \hat{\beta}_1, \ldots, \hat{\beta}_p} = -2 \sum_{i=1}^{n} \left(Y_i - \beta_0 - \sum_{j=1}^{p} \beta_j X_{ij}\right) X_{ij} = 0,\ j = 1,2, \ldots, n$ (e)

2.3 Test for the Significance of the Estimated Model Parameters/Regression Coefficients:

The appropriate hypotheses are

Hypothesis

$H_0 : \beta_0 = \beta_1 = \ldots = \beta_p = 0$

$H_1 : \beta_j \neq 0$ for at least one $\boldsymbol{j}$.

Decision Rule: we reject H_0 if $F > F_{k,n-k-1}(\alpha)$, H_0 would be rejected if p-value < .05, implying that the statistical test is significant or that at least one of the predictors $x_1, x_2, . . ., x_p$ contributes significantly to the model.

TABLE : 1

Analysis *of Variance for Significance of Regression in Multiple Regression*

Source of Variation	Degree of Freedom	Sum of Squares	Mean Squares	F_0
Regression	k	SS_R	MS_R	MS_R/MS_{Res}
Residual	$n-k-1$	SS_{Res}	MS_{Res}	
Total	$n-1$	SS_T		

The test procedure is to compute the statistic $F = MS_R/MS_{Res}$ and H_0 would be rejected if $F > F_{k,n-k-1}(\alpha)$.

2.4 Testing for Model Adequacy:

Coefficient of Determination (r^2) can be expressed as

$$r^2 = \frac{\sum_{i=1}^{n} e_i^2}{\sum_{i=1}^{n}(y_i-\bar{y})^2} \quad \text{(h)}$$

Generalization of R^2: the coefficient of determination can be generalize by inspection of r^2 for a simple linear model. For a simple linear model (one independent variable) we have that $r^2(R^2{}_{y,x}) = \frac{\hat{\beta}_1 \sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(y_i-\bar{y})^2}$ (k)

For two or more independent variables, it is generally expressed as

$$R^2{}_{,x_1,x_2,...,x_k} = \frac{\hat{\beta}_1\hat{\beta}_1 \sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y}) + . . . + \hat{\beta}_k \sum_{i=1}^{n}(x_k-\bar{x})(y_k-\bar{y})}{\sum_{i=1}^{n}(y_i-\bar{y})^2} \quad \text{(l)}$$

The adjusted R^2 ($\bar{R}^2$) : $\bar{R}^2$ is given by: $1-(1-R^2)\frac{n-1}{n-k}$.

III. Results and Discussion

The result will be presented on different tables. The multiple linear regression technique model would be built, their adequacies tested and prediction made with the most adequate model. The hypotheses to be tested for these models are:

The Multiple Linear Regression Model (GDP Per Capita on Population Growth, Youth Unemployment Rate, Net Migration Rate)

Table 3.1: *Descriptive Statistics*

	Mean	Std. Deviation	N
GDP per capita	1864.8430	793.81829	20
Population Growth	158.20	24.653	20
Net migration rate	-.32470	.057521	20
Youth Unemployment Rate	10.2950	2.73822	20

Table3.2

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.942[a]	.888	.867	289.22995	.888	42.374	3	16	.000

Table 3.3: *ANOVA*[a]

Source Variation	Df	Sum of Squares	Mean Square	F	Sig.
Regression	3	10634338.636	3544779.545	42.374	.000[b]
Residual	16	1338463.389	83653.962		
Total	19	11972802.026			

a. Dependent Variable: Gross Domestic Product per capita

b. Predictors: (Constant), Youth Unemployment Rate, Net migration rate, Population growth in a given year

a. Predictors: (Constant), Youth Unemployment Rate, Net migration rate, Population growth in a given year

The model as a whole was significant, *F* (*3,16*) =42.374, p< .001 as shown by ANOVA table. R^2 for the overall model was 88% with an adjusted R^2 ($\overline{R}^2$) of 86%, and a high size effect is reported by the model i.e., 88% variation of the GDP per capita was explained by the linear combination of the predictor variables (Youth Unemployment Rate, Net migration rate, Population growth in a given year)

Table 3.4 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	β	T	Sig.
1	(Constant)	-2673.822	516.907		-5.173	.000
	Population Growth	27.602	4.814	.857	5.734	.000
	Net migration rate	-4322.799	1729.735	-.313	-2.499	.024
	Youth Unemployment Rate	-119.631	40.169	-.413	-2.978	.009

a. Dependent Variable: Gross Domestic Product per capita

From Table 3.4 our estimated model is expressed as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{\beta}_3 x_3$

Where $x_1 =$ Population growth, $x_2 =$ Youth Unemployment Rate, and $x_3 =$ Net migration rate

$$\hat{y}_i = -2673.822 + 27.602(\text{Population growth}) - 119.631(\text{Youth Unemployment Rate}) - 4322.799(\text{Net migration rate})$$

Report of Results/Analysis: this study was conducted to determine if the effects of population growth, youth unemployment rate and net migration rate on GDP per capita would be statistically significant. It was hypothesized that population growth, youth unemployment rate and net migration rate would have a significant effect on GDP per capita. To test this hypothesis, multiple linear regression was used. Results shows that 86% of the variance in GDP per capita can be accounted for by the three predictors collectively *F* (*3,16*) = 42.374, p <.001. looking at the unique individual contributions of the predictors, the result shows that population growth (β =.857, t=5.734, p=.001) positively predicts GDP per capita. Furthermore, result also reveals that youth unemployment rate (β = -.413, t=-2.978, p=.009) and net migration rate (β =-.313, t=-2.499, p=.024) would predict and have a significant effect on GDP per capita negatively.

IBM SPSS Outputs of The Simple Linear Regression Model (Population Growth On GDP Per Capita)

Table 3.5 Descriptive Statistics

	Mean	Std. Deviation	N
GDP per capita	1864.8430	793.81829	20
Population growth	158.20	24.653	20

Table 3.6 Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.754[a]	.569	.545	535.63392	.569	23.731	1	18	.000

a. Predictors: (Constant), Population growth

Table3.7

ANOVA[a]

Source Variation	df	Sum of Squares	Mean Square	F	Sig.
Regression	1	6808535.500	6808535.500	23.731	.000[b]
Residual	18	5164266.525	286903.696		
Total	19	11972802.026			

a. Dependent Variable: GDP per capita

b. Predictors: (Constant), Population growth

Table 3.8

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	-1976.605	797.607		-2.478	.023
	Population growth	24.282	4.985	.754	4.871	.000

a. Dependent Variable: GDP per capita

Report of Result/Analysis: This study was conducted to determine the effect of population growth on GDP per capita. Population growth explains a significant proportion of variance in GDP per capita, R^2 =54%, *F*(*1, 18*) = 23.731, p< .001. Population growth will significantly predict GDP per capita, (β =.754, *t*=4.871, *p*<.001). The estimated model from the result is given as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x$ where $x_1 =$ population growth

Therefore the estimated simple linear regression model is given as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_,$ => $\hat{y}_i = -1976.605 + 24.282(\text{population growth})$. Meaning that for each unit increase in population growth, there will be 24.282 increase in GDP per capita.

IBM SPSS Outputs of the Simple Linear Regression Model (Youth Unemployment Rate on GDP Per Capita)

Table 3.9

Descriptive Statistics

	Mean	Std. Deviation	N
GDP per capita	1864.8430	793.81829	20
Youth Unemployment Rate	10.2950	2.73822	20

Table 4.0
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.010[a]	.000	-.055	815.52778	.000	.002	1	18	.966

a. Predictors: (Constant), Youth Unemployment Rate

Table 4.1
ANOVA[a]

Source Variation	Df	Sum of Squares	Mean Square	F	Sig.
Regression	1	1262.033	1262.03	0.002	.966[b]
Residual	18	11971539.99	665086		
Total	19	11972802.03			

a. Dependent Variable: GDP per capita
b. Predictors: (Constant), Youth Unemployment Rate

Table 4.2

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1834.201	726.681		2.524	.021
	Youth Unemployment Rate	2.976	68.327	.010	.044	.966

a. Dependent Variable: GDP per capita

Report of Result/Analysis: This study was conducted to determine the effect of youth unemployment rate on GDP per capita. Youth unemployment rate explains no significant proportion of variance in GDP per capita, R^2 = -.055%, $F(1,\ 18)$ = 0.002, p= .966. Youth unemployment rate will not have significant effect on GDP per capita, (β =.010, t=.044, p>.05).The estimated model from the result is given as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x$ where $x =$ youth unemployment rate.
Therefore the estimated simple linear regression model is given as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x \Rightarrow \hat{y}_i = 1834.201 + 2.976(\text{youth unemployment rate})$. Meaning that for each unit increase in youth unemployment rate, there will be 2.976 increase in GDP per capita.

Table 4.3
Descriptive Statistics

	Mean	Std. Deviation	N
GDP per capita	1864.8430	793.81829	20
Net migration rate	-.32470	.057521	20

IBM SPSS Outputs of the Simple Linear Regression Model (Net Migration Rate On GDP Per Capita)

Table 4.4
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.785[a]	.617	.596	504.77544	.617	28.989	1	18	.000

a. Predictors: (Constant), Net migration rate

Table 4.6
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1654.795	663.373		-2.495	.023
	Net migration rate	-10839.661	2013.245	-.785	-5.384	.000

a. Dependent Variable: GDP per capita

Report of Result/Analysis: this study was conducted to determine the effect of net migration rate on GDP per capita. net migration rate explains a significant proportion of variance in GDP per capita, R^2 = 59%, *F*(*1, 18*) = 28.989, p<.001. Net migration rate will have significant effect on GDP per capita, (β = -.785, *t*=-5.384,

Table 4.5
ANOVA[a]

Source Variation	df	Sum of Squares	Mean Square	F	Sig.
Regression	1	7386433.546	7386433.546	28.989	.000[b]
Residual	18	4586368.480	254798.249		
Total	19	11972802.026			

a. Dependent Variable: GDP per capita

b. Predictors: (Constant), Net migration rate

p<.001).The estimated model from the result is given as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x$ where $x =$ net migration rate. Therefore the estimated simple linear regression model is given as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x => \hat{y}_i = -1654.795 - 10839.661(\text{net migration rate})$. Meaning that for each unit increase in net migration rate, there will be -10839.661 decrease in GDP per capita.

4.4 Summary of Reported Results/Analyses

Table 4.7
Table summary of all reported analyses/results

Estimated Models	**Parameter Estimates**	**P-value (F_0)**	R^2	$\bar{R}^2$	**Significance**

$\hat{y}_i = -2673.822 + 27.602x_1 - 119.631x_2 - 4322.799x_3$ (GDP per capita on Population growth, youth unemployment rate and net migration rate)	$\beta_0 = -2673.822$ $\beta_1 = 27.602$ $\beta_2 = -119.631$ $\beta_3 = -4322.799$	.000	.888	.867	This model is Significant
$\hat{y}_i = 114.527 + 0.023x$ (Population growth on GDP per capita)	$\beta_0 = 114.527$ $\beta_1 = 0.023$	.000	.569	.545	This model is Significant
$\hat{y}_i = 10.229 + 3.545\text{e} - 005x$ (Youth unemployment rate on GDP per capita)	$\beta_0 = 10.229$ $\beta_1 = 3.545\text{e} - 005$	.966	.000	-.055	This model is not Significant
$\hat{y}_i = -1654.795 - 10839.661x$ (Net migration rate on GDP per capita)	$\beta_0 = -1654.795$ $\beta_1 = -10839.661$	.000	.617	.596	This model is Significant

Estimated Models: from the summary table 4.7 above, the estimated linear regression models are:
$\hat{Y}_i = -2673.822 + 27.602x_1 - 119.631x_2 - 4322.799x_3$ (Population growth, youth unemployment rate, and net migration rate on GDP per capita).

4.6 Test of Significance of Linear Regression Models:
For $\hat{Y}_i = -2673.822 + 27.602x_1 - 119.631x_2 - 4322.799x_3$ (Population growth, youth unemployment rate, and net migration rate on GDP per capita): P-value(.000) is less than .05, the null hypothesis would be rejected, and we conclude that, the effects of Population growth, youth unemployment rate, and net migration rate on GDP per capita is significant.

4.7 Test of Models Adequacy: from table 4.8 above the adjusted R^2 for each of the model is given below as:
$\hat{Y}_i = -2673.822 + 27.602x_1 - 119.631x_2 - 4322.799x_3$ (Population growth, youth unemployment rate, and net migration rate on GDP per capita) = .867(86%)
The above results show that the most adequate model is that of multiple linear regression of Population growth, youth unemployment rate, and net migration rate on GDP per capita having adjusted R^2 of 86% meaning that 86% of the total variations, in GDP per capita is accounted for by the model where the remaining 14% was not accounted for due to errors inherent in the model.

4.8 Predicting with the most adequate model: The most adequate model gotten from the analysis is given by:

$$\hat{y}_i = -2673.822 + 27.602(\text{Population growth}) - 119.631(\text{Youth Unemployment Rate}) - 4322.799(\text{Net migration rate})$$

Given the population growth for Nigeria in 2021 to be 211 Million, the youth unemployment rate estimated at 32.5% in 2021 and the net migration rate to be -0.288. Using the estimated multiple linear regression model, the GDP per capita for Nigeria in 2021 would be estimated as:
$\hat{y}_i = -2673.822 + 27.602(211) - 119.631(32.5) - 4322.799(-.288)$ = 507.159.
From the result, GDP per capita was estimated to be 507.159 in 2021. The result shows a decrease in GDP per capita as population growth, net migration rate and youth unemployment rate go higher.

IV. Summary and Conclusion

This study examined the effects of population growth, youth unemployment rate and net migration rate, and the individual effect of each of the aforementioned independent variables on Gross Domestic Product (GDP) per capita for a period of 20 years (2000-2019). The dependent variable is GDP per capita and the independent variables are population growth, youth unemployment rate and net migration rate. IBM SPSS Statistics, version 22.0 was used to run this statistical analysis in order to check if our result will help us to either reject or accept our statistical claims (Null and Alternative hypotheses). The null hypothesis is that there is no significant effect that the predictor variables (population growth, youth unemployment rate and net migration rate) will have on the outcome variable (GDP per capita), and the alternative hypothesis is that there will be a significant effect those predictor variables will have on the outcome variable. The analysis was carried out by building four different regression models, which were tested through their adjusted $\boldsymbol{R^2}$ and it was found that the best/most adequate model for prediction is that of the multiple linear regression of population growth, youth unemployment rate and net migration rate on GDP per capita, having the highest adjusted R^2 (86%). The result of the analysis also showed that three linear regression models (population growth on GDP per capita, net migration rate on GDP per capita, population growth, youth unemployment rate and net migration rate on GDP per capita) are statistically significant in predicting GDP per capita (having p-values less than .05), while the remaining one (youth unemployment rate on GDP per capita) is not statistically significant, because it has p-value greater than .05. From the result of the overall estimated multiple linear regression model given below with p-value less than .05,

$$\hat{y}_i = -2673.822 + 27.602(\text{Population growth}) - 119.631(\text{Youth Unemployment Rate}) - 4322.799(\text{Net migration rate}),$$

the null hypothesis was rejected, thereby, we conclude that the effects of population growth, youth unemployment rate, and net migration rate on GDP per capita is statistically significant.

References

[1]. Adenomon, M. O. and Oyejola, B. A. (2013). Impact of agriculture and industrialization on GDP in Nigeria: evidence from VAR and SVAR models. Int. J. Analysis and Application, 1:40-78.

[2]. Adenomon (2016) Analysis of Agriculture and Gross Domestic Product of Nigeria using First Difference Regression Model. Journal of the Nigerian Statistical Association. 28, 79– 94.

[3]. Ekezie, D. D; Mbachu, H.I.; Opara, J. (2013).Paradox in sum of a Linear and a Linear fractional transportation problem: International Journal of Applied Mathematics and Modeling (IJA2M), Vol.1(4):1-17. www.kindipublication.com

[4]. Fajana (2000). Functioning of the Nigerian Labour Market, Labonfin and Company, Lagos. P.23.

[5]. Gibbs,Y. Kanyongo, Janine Certo, Brown I. Launcelot (2006) Using regression analysis to establish the relationship between home environment and reading achievement: A case of Zimbabwe. International Education Journal,7(5), 632-641.

[6]. International Labour Organisation (ILO) (2004): Towards a Fair Deal For Migrant Workers in the Global Economy, Geneva. P.216.

[7]. Mbachu, H. I., Nduka E. C., Nja M. E. (2012). Designing a pseudo R-Squared Goodness-of-fit measure in Generalized Linear Models: Journal of Mathematics Research Toronto Canada. Vol. 4, No2. CANADIAN CENTRE OF SCIENCE & EDUCATION.

[8]. National Bureau of Statistics. (2012), National unemployment rates (1995 - 2011). Retrieved from www.nigerianstat.gov.ng on 9th November, 2012.

[9]. Nwanya J. C., Mbachu H. I., Dozie K. C. (2019) Design Optimality Criteria of Reduced Model for Variations of Central Composite Design. Archives of Current Research International. 19(4): 1-7; Article no. 54325

[10]. Olajide, O. T., Akinlabi B. H. and Tijani A. A. (2012). Agricultural resource and economic growth in Nigeria. European Science Journal. 8:103–115.

[11]. Piketty, T. (2014). Capital in the 21st Century, Cambridge, MA; Belknap Press of Harvard University Press.

Appendix

The data as shown on the appendix below shows the population growth, youth unemployment rate, net migration rate and the GDP per capita and ranges from a period of 20 years (2000 to 2019).

Table 2

Data on the population growth, youth unemployment rate, net migration rate and GDP per capita,(N=20)

YEAR	GDP PER CAPITA	POPULATION GROWTH (MILLIONS)	NET MIGRATION RATE (%)	YOUTH UNEMPLOYMENT RATE (%)
2000	**567.93**	**122**	**-.203**	**9.64**
2001	**590.38**	**125**	**-.222**	**9.64**
2002	**741.75**	**129**	**-.241**	**9.74**
2003	**795.38**	**131**	**-.260**	**9.75**
2004	**1007.87**	**135**	**-.289**	**9.66**
2005	**1268.38**	**139**	**-.318**	**9.55**
2006	**1656.42**	**143**	**-.346**	**9.35**
2007	**1883.46**	**146**	**-.375**	**9.19**
2008	**2242.87**	**150**	**-.404**	**9.13**

2009	**1891.34**	**154**	**-.394**	**9.49**
2010	**2280.44**	**159**	**-.384**	**5.58**
2011	**2487.60**	**163**	**-.373**	**9.56**
2012	**2732.82**	**167**	**-.363**	**9.68**
2013	**2961.55**	**172**	**-.353**	**9.84**
2014	**3098.99**	**174**	**-.344**	**8.41**
2015	**2687.48**	**181**	**-.366**	**7.81**
2016	**2176.00**	**186**	**-.327**	**12.48**
2017	**1968.56**	**191**	**-.319**	**13.91**
2018	**2027.78**	**196**	**-.310**	**15.80**
2019	**2229.86**	**201**	**-.303**	**17.69**

Sources: Federal Reserve Economic Data (https://fred.st.louisFed.org).
United Nations World-Population prospects (https://macrotrends.net>NGA)