



THE LONG-RUN RELATIONSHIP BETWEEN POPULATION AND ECONOMIC GROWTH – A COMPARATIVE STUDY OF TEN AFRICAN ECONOMIES

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Abstract: *The study was on the long-run relationship between population and economic growth – a comparative study of ten African economies with the highest GDP per capita growth in Africa. The problem of study here is that Africa's population has been increasing at a fast rate and if adequate planning is not made it could lead to rise in unemployment, lower wages and subsequently lower output equilibriums. For the technologically backward countries rising populations means lower per capita availability of capital. The methodology used was to test three hypotheses. By using granger causality, unit root tests, OLS and cointegration. The findings indicate that there are significant and positive correlations between population and GDP per capita over the 57 years under study. The recommendations include improved technology to increase exports, reduce unemployment and subsequently GDP per capita. Again the African countries needs to increase efforts at economic cooperation and diversification of their various economies for a synergy protecting them from competition given that other countries in the west and asia are in similar regional cooperations*

Keywords: Long-run, relationship, population, economic growth and African economies

1. Introduction

This study involves a historical data and a review of both theoretical and empirical work on the relationship among population, output and per capita output to evaluate the consequences of economic inequality, international migration policies, and general economic growth. With the growing

population of people across the globe, scarce resources and uneven technology among different economies the studies of the role and purpose of population on a country's economy over a long period of time becomes more compelling in macroeconomic research with time. There is an increasing pressure on global goods, factors of production, technological efficiency and

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markets. Countries with a higher population and lower GDP are likely to have a lower income per capita than countries with a higher GDP with the lower population. Countries in the category of the latter have the tendency for higher wages and higher productivity than those in the former category. Government policies are normally geared towards decreasing poverty, unemployment and inflation through better management and allocation of resources within and outside national borders. Governments have gone to war, signed bilateral and multilateral agreements all in a bid to ensure an enhanced position for their country. In attempts to capture the complex links between labour and growing the economy many researchers have studied the impact of population on economic growth of different nations but not many have undertaken studying several countries at once. These studies have involved a wide range models using data analyzed and interpreted in ways that has helped users of information solve problems or avert problems in similar areas. The global population growth can be influenced by cultural, environmental and in some cases regulatory factors. Birth rates, death rates and migration affect cost of labour, demand and prices. A country's export potentials and subsequently earnings affect its local currency standing and reserves. Of relevance to policy makers at the national and global level is the awareness of methods that facilitate development factors revealing factors which influence economic growth such as population. As economies get increasingly connected globally, there are still significant differences in not just the rate of economic growth but the propelling factors.

Government regulations in many countries including Africa has been influenced by globalization hence the theory of geographical mobility of labour cannot be over emphasized. Information

dissemination across markets, technological exchanges and outsourced production are prominent in today's economies as emphasis is now on growing sustainable economic wealth. It becomes necessary that these global market changes have the necessary feedbacks for research to be carried out for recommended improvements. Resource utilization is driven by international trade and government policies, but future development in the economy are influenced by the net impact of future development of factors of production through efficient allocation. Scarcity of resources can be alleviated through management intensification and technical progress, resource substitution moves along the production possibility curve at a higher speed with improved technology. But increased population without the necessary technology and adequate resources may not push these production frontiers to unattainable target levels. Uwe et al (2011) observes that population growth puts enormous pressure on supply of resources, prices and employment not necessarily due to interdependencies between population growth, technological development and the economy but due to the sensitivity of the ever increasing population and supply gap. Researchers have been developing models for the mathematical programming of data to facilitate the stimulation towards market equilibrium by maximizing surplus resources within and across borders with the increase in regional economic cooperation. But these measures have not been entirely flawless as Molden (2007) pointed out. The deviations observed take two major forms, firstly in data on population is not always accurate due to collation deficiencies especially in underdeveloped countries. Secondly, some models assume competitive markets and rational behaviour allowing little or nothing to suggest inclusion of variables adjusting human rationality. Demographic transitions



are reflective over time during population growth decline. Exogenous shifts in resource endowments are calculated based on changes in population. Population density challenges have been modeled by past researchers as approximated by making changes in population a function of specific factors depending on what is being studied. Income elasticity estimates have been modeled by many to determine the impact of population on wages and how consumption is affected. In the following sections of the article, the long-run relationships between population and economic growth for each African country are analyzed to assess the implications of their likely evolution for growing inequality around the continent and for population and migration policies.

1.1 Statement of research problem

The problem of study here is that Africa's population has been increasing at a fast rate and if adequate planning is not made it could lead to rise in unemployment, lower wages and subsequently lower output equilibriums. For the technologically backward countries rising populations means lower per capita availability of capital. This affects capital formation due to an uneven gap between population increase and increases in investments since lower wages and inflation has reduced the capacity to save causing a drop in total national savings. Rapid growth, rural –urban migration, wars and communal dispute and farm land encroachment put pressure on food prices leading to undernourishment of the working segment of the population and a decline in its attendant productivity. Social infrastructure faces the pressures of rising population and lower standards of living.

1.1.2 Research objectives

The broad objective of this research work is to establish the effect of population growth on economic growth. The specific objectives are;

[1] To ascertain the magnitude of effect of population growth on economic growth.

[2] To investigate the causal relationship between population growth and economic growth.

[3] To determine whether long run relationship exist between population growth and economic growth.

1.1.3 Research hypotheses

The research hypotheses are as follows;

H01: Population growth has no significant effect on economic growth.

H02: There is no significant causal relationship between population growth and economic growth.

H03: There is no long run relationship between population growth and economic growth.

2.0 Literature review

Heady & Hodge (2009) held that economic growth among the high-income countries will be slower in the long run because of population growth. Population growth is an influencing variable where age, structure of a country's population, international migration, economic inequality, and the size of a country's work force. These factors are a function of overall economic growth. Thomas Piketty (2014) observes that economic growth “. . . always includes a purely demographic component and a purely economic component, and only the latter allows for an improvement in the standard of living. Changes in Gross Domestic Product (GDP) can be broken down into population and economic elements.

Piketty (2014) described the workings of a capitalist economic system by developing a number of economic relationship and tracing the implications of these relationships for changes in economic inequality. Of central importance in this analysis is the



relationship between economic growth and the rate of return to capital. He argues that there will be concentration in the ownership of capital leading to increasing inequality when the rate of return to capital is greater than the economic growth rate ($r > g$ in his notation). In a later article, Piketty (2015) concluded this result noting that other factors as well as economic policies contribute importantly to the evolution of economic inequality. He went further to suggest that large gaps between r and g will tend to amplify the effects of these other factors. Baker et al. (2005) agree noting that slowing population growth in the United States is part of the reason that future U.S. economic growth will be lower than it was for most of the 20th century. Population growth is falling in many parts of the world and once the demographic transition is completed in sub-Saharan Africa and other areas of robust population growth, world population growth will probably return to historic levels of less than 1% per year. Average annual growth in per capita output has also been fairly modest over the past 200 years accelerating during periods when very poor countries begin to catch up with more highly developed economies or when rapid productivity growth is achieved as was the case in many countries during the 20th century. The danger of slow economic growth in Piketty's view is that the resulting concentration of capital will help to bring back the patrimonial capitalism of the 19th century when one's fortune was more effectively made by marrying an heir to great wealth than by working to develop one's talents in the service of a productive career. The importance of economic growth in raising standards of living cannot be over emphasized, with the increase in geographical mobility of labour resulting from urban and cross-country migration and outsourcing of labour with the view to reduce costs or widen market spread.

Malthus and Smith (1978) in their economic and technological development allowed for no per capita growth as capital remains fixed. However, this model has not been successful in third world societies unlike the more economically developed and advanced economies. This led to creation of multiphase models by Simon (1986) and Galor and Weil (1998). Galor and Weil (1998) in replicating a model assumed that the current economic circumstances prevalent today is much more dynamic and complex than the one observed by Malthus. Critics of the model by Malthus postulate that even when if the current economic environment applies the same mechanism as common to past situations that there is yet to be a consensus as to accuracy of growth models at portraying trends of population and economic growth but also by specifying the mechanism in which economic growth occurs.

Simon (1977) postulated a theory where he maintains that the greater the total population and level of technological growth the greater the per capita income, this he refers to as "*population push*" model. The inclusion of a technological growth function in the model is necessary for endogenous technological progress. This has been tested with replicated results in studies savings rate disparity and its attendant effects on output on Japan and the United States of America. The results of the model yield modest per capita economic growth at equilibrium and Simon determines that maximized long term economic growth (always in per capita terms unless otherwise noted) requires 1-2% per annum population growth and a 2-4% rate of savings with a low discount rate below 4%. At a higher discount rate of 5-10% there was still increased consumption. This population growth rate, he makes clear, is higher than the rate that produces the highest adoption of technology (Simon 1986). Any growth that occurs too fast will



have diminishing return or create a circumstance where is stagnating. As well, modest negative population growth will have the effect of limiting growth but large negative out flows in population will stagnate growth outright. The level of total technology (available and in use) never decreases since this is, in his estimation, illogical.

3.0 Research methodology

The research instrument employed in the course of this analysis is the econometric method because it facilitates model specification, parameter estimation, and the conduct of appropriate statistical and econometric tests.

3.1 Model specification

Because of the approach intended, we can specify the model with the following functional relationship mathematically as $GDP/PC = F (POP)$ ----- (1)

The model is specified econometrically as;
 $GDP/PC_t = \beta_0 + \beta_1 POP_t + \mu_t$ -----(2)

MODEL 2

Model 2 is specified to determine the direction of causality between RGDP and POP.

$$GDP/PC_t = \sum_{i=1} \alpha_i POP_{t-i} + \sum_{j=1} \beta_j GDP/PC_{t-j} + \mu_{1t}$$
----- (3)

$$POP_t = \sum_{i=1} \lambda_i POP_{t-i} + \sum_{j=1} \beta_j GDP/PC_{t-j} + \mu_{2t}$$
----- (4)

MODEL 3 To find whether there is long run steady state path, equation (2) is remodeled as;

$$\mu_t = GDP/PC_t - \beta_0 - \beta_1 POP_t$$
----- (5)

To know the rate at which short run disequilibrium is adjusted, we model the Error correction mechanism

(ECM) as;
 $GDP/PC_t = \beta_0 + \beta_1 POP_t + \mu_{t-1} + \varepsilon_t$

Where;

GDP/PC = Gross Domestic Product Per Capita

POP = Population

μ_t = Stochastic Error Term

ε_t = New stochastic Error Term

μ_{t-1} = The Error Correction Factor

3.2 Estimation procedure

The Carl Fried-Rich Gauss model of Ordinary Least Square (OLS) also known as Gaussion classical linear regression model (CLRM) was employed in estimation. This was preferred because of the ease of understanding and unbiasedness and for accuracy and precision the highly recommended E-views statistical package was used to analysis the data.

Assumption 1. The first assumption is that the regression model is linear in parameter $Y_i = B_1 + B_2 X_i + u_t$

Assumption 2 The second assumption is that the independent variables (x_i) values are fixed in repeated sampling, put more technically, x_j are assumed to be non-stochastic.

Assumption 3 The third assumption is that the disturbance term has a zero mean value. $E(\mu_i/X_i) = 0$.

Assumption 4 The fourth assumption is that there is a presence of homoscedasticity given values of X, the variances of μ_i is the same for all observations that is $Var (\mu_i/X_i) = B2$.

Assumption 5 The fifth assumption is that there is no autocorrelation between the disturbance term that is $cov (\mu_i, \mu_j/X_i, X_j) = 0$

Assumption 6 The sixth assumption is that there is zero covariance between μ_i and X_i $Cov (\mu_i, X_i) = 0$

Assumption 7 The sixth assumption is that the number of observation (n) must be greater than the number of parameter to be estimated.



Assumption 8 The final assumption is that there is no perfect multicollinearity among the explanatory variable. That is $E(X_j, X_i) = 0$ Others include that the models are correctly specified and that there is variability in X 's values.

Techniques for the evaluation of the results: Economic a-priori expectation is the technique for evaluation of the results after analyzing the statistical tests of significance and econometric tests.

Evaluation based on economic criteria: Given these criteria to establish the presence of conformity to economic theory, a priori expectation (signs and size) of the parameter estimates of the variables in the model will be evaluated.

Evaluation based on statistical criteria (First Order Test)

R2: These measures are necessary in explaining the total variation in the dependent variable (Gross Domestic Product/Per Capita) caused by variations in the explanatory variable (population growth) included in the model.

The t – Test This test is necessary in determining the statistical significance or otherwise of the variables included in the model. Adopting the $-2 - t1$ rule of significance we reject H_0 if the computed $t -$ value is greater than 2. This implies that the variable is statistically significant.

The f-Test In determining the overall significance of the regression model, this test is vital. If the $P -$ value of f obtained is sufficiently low we reject the H_0 .

4.0 Analysis of data

NIGERIA

Table 4.0.1

Pairwise Granger Causality Tests

Date: 12/02/18 Time: 13:29

Sample: 1960 2017

Evaluation based on econometric criteria (second order test stationary test)

Stationarity test determines if the stochastic term mean value and variance are constant overtime. The Augmented Dickey – Fuller (ADF) test was recommended for its accuracy and precision in similar studies.

Cointegration test: In order to determine if the variables have a long term relationship and are stable overtime, cointegration test is required. This is vital due to their different order of integration. The residuals test resulting from the Augmented Dickey - Fuller will be used to confirm the existence or otherwise of long-run relationship between the dependent and independent variables.

Granger – Causality Test: The Granger Causality test is fundamentally essential in determining the responses in the two variables are unidirectional causality or bilateral causality. As popular as Granger causality tests have been in studies of this nature one has to point out as a mark of caution that in using Granger test one should understand its sensitive to the lag length used in the model. Granger causality follows the F-distribution. If the computed $F -$ value exceeds the critical $F -$ value at 5% level of α , we reject the null hypothesis with

M

$n - k$ degree of freedom (df).

$M =$ number of lagged m term.

$K =$ number of parameters estimated.



Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$_	56	2.47067	0.0946
GDP_PER_CAPITA__\$_ does not Granger Cause POPULATION		1.52627	0.2271

Table 4.0.2

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/02/18 Time: 13:34

Sample: 1960 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 8

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.25650	0.9880	2	104
Breitung t-stat	-1.20944	0.1132	2	102
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat				
	-2.13558	0.0164	2	104
ADF - Fisher Chi-square				
	23.2286	0.0001	2	104
PP - Fisher Chi-square				
	23.6123	0.0001	2	112

** Probabilities for Fisher tests are computed using an asymptotic



Chi
-square distribution. All other tests assume asymptotic
normality.

Table 4.0.3

Dependent Variable: GDP_PER_CAPITA__\$_

Method: Least Squares

Date: 12/02/18 Time: 13:38

Sample: 1960 2017

Included observations: 58

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	1.53E-05	1.56E-06	9.795837	0.0000
C	-824.8849	169.2308	-4.874320	0.0000
R-squared	0.631478	Mean dependent var		701.4306
Adjusted R-squared	0.624897	S.D. dependent var		821.2124
S.E. of regression	502.9566	Akaike info criterion		15.31276
Sum squared resid	14166060	Schwarz criterion		15.38381
Log likelihood	-442.0700	Hannan-Quinn criter.		15.34043
F-statistic	95.95843	Durbin-Watson stat		0.193771
Prob(F-statistic)	0.000000			

SOUTH AFRICA

Table 4.0.4

Pairwise Granger Causality Tests

Date: 12/02/18 Time: 15:22

Sample: 1960 2017

Lags: 2



Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$_	56	6.09708	0.0042
GDP_PER_CAPITA__\$_ does not Granger Cause POPULATION		13.4254	2.E-05

Table 4.0.5

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/02/18 Time: 15:23

Sample: 1960 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 1 to 7

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.90641	0.8176	2	104
Breitung t-stat	0.42085	0.6631	2	102
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.74556	0.0030	2	104
ADF - Fisher Chi-square	19.4535	0.0006	2	104
PP - Fisher Chi-square	12.0265	0.0172	2	112

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.



Table 4.0.6

Dependent Variable: GDP_PER_CAPITA__\$

Method: Least Squares

Date: 12/02/18 Time: 15:25

Sample: 1960 2017

Included observations: 58

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	0.000157	8.79E-06	17.86504	0.0000
C	-2675.242	338.5389	-7.902316	0.0000

R-squared	0.850730	Mean dependent var	3068.919
Adjusted R-squared	0.848065	S.D. dependent var	2070.175
S.E. of regression	806.9310	Akaike info criterion	16.25823
Sum squared resid	36463706	Schwarz criterion	16.32928
Log likelihood	-469.4886	Hannan-Quinn criter.	16.28590
F-statistic	319.1596	Durbin-Watson stat	0.292799
Prob(F-statistic)	0.000000		

ETHIOPIA

Table 4.0.7

Pairwise Granger Causality Tests

Date: 12/02/18 Time: 15:34

Sample: 1981 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$	35	5.64791	0.0083
GDP_PER_CAPITA__\$ does not Granger Cause POPULATION		1.42119	0.2572



Table 4.0.8

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/02/18 Time: 16:58

Sample: 1981 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 1 to 8

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.66829	0.9962	2	61
Breitung t-stat	-0.03783	0.4849	2	59
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W- stat	-5.12178	0.0000	2	61
ADF - Fisher Chi-square	29.7594	0.0000	2	61
PP - Fisher Chi-square	12.1718	0.0161	2	70

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.9

Dependent Variable: GDP_PER_CAPITA__\$_

Method: Least Squares

Date: 12/02/18 Time: 16:59

Sample: 1981 2017

Included observations: 37



Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	5.57E-06	1.03E-06	5.428418	0.0000
C	-100.5048	71.49913	-1.405678	0.1686
R-squared	0.457093	Mean dependent var		270.1115
Adjusted R-squared	0.441581	S.D. dependent var		172.8420
S.E. of regression	129.1604	Akaike info criterion		12.61253
Sum squared resid	583884.2	Schwarz criterion		12.69960
Log likelihood	-231.3317	Hannan-Quinn criter.		12.64322
F-statistic	29.46772	Durbin-Watson stat		0.080472
Prob(F-statistic)	0.000004			

EGYPT

Table 4.0.10

Pairwise Granger Causality Tests

Date: 12/02/18 Time: 22:34

Sample: 1965 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$_	51	2.37629	0.1042
GDP_PER_CAPITA__\$_ does not Granger Cause POPULATION		6.25570	0.0040

Table 4.0.11

Group unit root test: Summary



Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/02/18 Time: 22:36

Sample: 1965 2017

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 1 to 4

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	3.40010	0.9997	2	99
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.07708	0.9811	2	99
ADF - Fisher Chi-square	4.83534	0.3046	2	99
PP - Fisher Chi-square	0.33440	0.9875	2	104

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.12

Dependent Variable: GDP_PER_CAPITA__\$_

Method: Least Squares

Date: 12/02/18 Time: 22:44

Sample: 1965 2017

Included observations: 53

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	4.50E-05	2.76E-06	16.29750	0.0000
C	-1580.612	173.5656	-9.106711	0.0000



R-squared	0.838918	Mean dependent var	1108.101
Adjusted R-squared	0.835759	S.D. dependent var	968.6492
S.E. of regression	392.5607	Akaike info criterion	14.82026
Sum squared resid	7859300.	Schwarz criterion	14.89462
Log likelihood	-390.7370	Hannan-Quinn criter.	14.84886
F-statistic	265.6086	Durbin-Watson stat	0.250325
Prob(F-statistic)	0.000000		

KENYA

Table 4.0.13

Pairwise Granger Causality Tests

Date: 12/03/18 Time: 08:53

Sample: 1960 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$_	56	1.97867	0.1487
GDP_PER_CAPITA__\$_ does not Granger Cause POPULATION		1.48778	0.2355

Table 4.0.14

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/03/18 Time: 08:55

Sample: 1960 2017



Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 2 to 3

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.64679	0.0041	2	107
Breitung t-stat	-0.12722	0.4494	2	105
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.41147	0.0000	2	107
ADF - Fisher Chi-square	31.9071	0.0000	2	107
PP - Fisher Chi-square	13.5861	0.0087	2	112

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.15

Dependent Variable: GDP_PER_CAPITA__\$

Method: Least Squares

Date: 12/03/18 Time: 08:56

Sample: 1960 2017

Included observations: 58

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	2.69E-05	1.73E-06	15.56977	0.0000
C	-191.8308	47.17262	-4.066571	0.0002
R-squared	0.812344	Mean dependent var		462.8557
Adjusted R-squared	0.808993	S.D. dependent var		372.5888



S.E. of regression	162.8377	Akaike info criterion	13.05726
Sum squared resid	1484902.	Schwarz criterion	13.12831
Log likelihood	-376.6605	Hannan-Quinn criter.	13.08493
F-statistic	242.4177	Durbin-Watson stat	0.086103
Prob(F-statistic)	0.000000		

SUDAN

Table 4.0.16

Pairwise Granger Causality Tests

Date: 12/03/18 Time: 09:07

Sample: 1960 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$	56	2.25313	0.1154
GDP_PER_CAPITA__\$ does not Granger Cause POPULATION		5.15306	0.0092

Table 4.0.17

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$, POPULATION

Date: 12/03/18 Time: 09:09

Sample: 1960 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 8

Newey-West automatic bandwidth selection and Bartlett kernel



Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.52711	0.9942	2	104
Breitung t-stat	-0.96419	0.1675	2	102
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.16742	0.0000	2	104
ADF - Fisher Chi-square	28.6730	0.0000	2	104
PP - Fisher Chi-square	31.4935	0.0000	2	112

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.18

Dependent Variable: GDP_PER_CAPITA__\$

Method: Least Squares

Date: 12/03/18 Time: 09:10

Sample: 1960 2017

Included observations: 58

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	5.33E-05	5.21E-06	10.22487	0.0000
C	-457.5752	120.9791	-3.782266	0.0004
R-squared	0.651195	Mean dependent var		659.6370
Adjusted R-squared	0.644966	S.D. dependent var		663.8076
S.E. of regression	395.5280	Akaike info criterion		14.83219
Sum squared resid	8760773.	Schwarz criterion		14.90324
Log likelihood	-428.1336	Hannan-Quinn criter.		14.85987



F-statistic	104.5480	Durbin-Watson stat	0.094063
Prob(F-statistic)	0.000000		

MOROCCO

Table 4.0.19

Pairwise Granger Causality Tests

Date: 12/03/18 Time: 09:26

Sample: 1960 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$	56	2.88195	0.0652
GDP_PER_CAPITA__\$ does not Granger Cause POPULATION		11.6210	7.E-05

Table 4.0.20

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$, POPULATION

Date: 12/03/18 Time: 09:27

Sample: 1960 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 3

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.17757	0.1195	2	109
Breitung t-stat	-1.91883	0.0275	2	107



Null: Unit root (assumes individual unit root process)

Im, Pesaran and Shin W-stat	-4.99399	0.0000	2	109
ADF - Fisher Chi-square	30.4182	0.0000	2	109
PP - Fisher Chi-square	25.0951	0.0000	2	112

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.21

Dependent Variable: GDP_PER_CAPITA_\$_

Method: Least Squares

Date: 12/03/18 Time: 09:28

Sample: 1960 2017

Included observations: 58

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	0.000129	6.00E-06	21.52138	0.0000
C	-1821.915	149.0696	-12.22191	0.0000
R-squared	0.892135	Mean dependent var		1258.393
Adjusted R-squared	0.890209	S.D. dependent var		957.6961
S.E. of regression	317.3295	Akaike info criterion		14.39163
Sum squared resid	5639089.	Schwarz criterion		14.46268
Log likelihood	-415.3573	Hannan-Quinn criter.		14.41931
F-statistic	463.1697	Durbin-Watson stat		0.157828
Prob(F-statistic)	0.000000			

LIBYA

Table 4.0.22

Pairwise Granger Causality Tests



Date: 12/03/18 Time: 09:37

Sample: 1990 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$_	26	2.60683	0.0974
GDP_PER_CAPITA__\$_ does not Granger Cause POPULATION		6.50002	0.0063

Table 4.0.23

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/03/18 Time: 09:38

Sample: 1990 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 5

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	8.68169	1.0000	2	47
Breitung t-stat	-1.69915	0.0446	2	45
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.47712	0.0000	2	47
ADF - Fisher Chi-square	25.6251	0.0000	2	47
PP - Fisher Chi-square	22.3955	0.0002	2	52

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.



Table 4.0.24

Dependent Variable: GDP_PER_CAPITA__\$

Method: Least Squares

Date: 12/03/18 Time: 09:39

Sample: 1990 2017

Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	0.001867	0.000810	2.304651	0.0294
C	-2944.470	4542.414	-0.648217	0.5225
R-squared	0.169632	Mean dependent var		7464.982
Adjusted R-squared	0.137695	S.D. dependent var		2749.473
S.E. of regression	2553.171	Akaike info criterion		18.59681
Sum squared resid	1.69E+08	Schwarz criterion		18.69197
Log likelihood	-258.3553	Hannan-Quinn criter.		18.62590
F-statistic	5.311416	Durbin-Watson stat		1.115570
Prob(F-statistic)	0.029427			

ANGOLA

Table 4.0.25

Pairwise Granger Causality Tests

Date: 12/03/18 Time: 10:39

Sample: 1980 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$	36	4.62216	0.0175
GDP_PER_CAPITA__\$ does not Granger Cause POPULATION		0.27448	0.7618



Table 4.0.26

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/03/18 Time: 10:40

Sample: 1980 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 8

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.11439	0.4545	2	64
Breitung t-stat	0.22319	0.5883	2	62
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.33341	0.0912	2	64
ADF - Fisher Chi-square	6.82779	0.1453	2	64
PP - Fisher Chi-square	4.43868	0.3499	2	72

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.27

Dependent Variable: GDP_PER_CAPITA__\$_

Method: Least Squares

Date: 12/03/18 Time: 10:41

Sample: 1980 2017



Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	0.001663	0.000211	7.879574	0.0000
C	10997.75	3828.565	2.872552	0.0068
R-squared	0.632981	Mean dependent var		39431.65
Adjusted R-squared	0.622786	S.D. dependent var		12838.64
S.E. of regression	7885.199	Akaike info criterion		20.83456
Sum squared resid	2.24E+09	Schwarz criterion		20.92075
Log likelihood	-393.8566	Hannan-Quinn criter.		20.86522
F-statistic	62.08769	Durbin-Watson stat		0.122773
Prob(F-statistic)	0.000000			

ALGERIA

Table 4.0.28

Pairwise Granger Causality Tests

Date: 12/03/18 Time: 10:27

Sample: 1960 2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
POPULATION does not Granger Cause GDP_PER_CAPITA__\$_	56	1.46693	0.2402
GDP_PER_CAPITA__\$_ does not Granger Cause POPULATION		49.5266	1.E-12

Table 4.0.29

Group unit root test: Summary

Series: GDP_PER_CAPITA__\$_, POPULATION

Date: 12/03/18 Time: 10:28



Sample: 1960 2017

Exogenous variables: Individual effects, individual linear trends

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 4

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.59966	0.7256	2	108
Breitung t-stat	-0.86870	0.1925	2	106
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.21324	0.0000	2	108
ADF - Fisher Chi-square	27.4378	0.0000	2	108
PP - Fisher Chi-square	26.3335	0.0000	2	112

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 4.0.30

Dependent Variable: GDP_PER_CAPITA__\$

Method: Least Squares

Date: 12/03/18 Time: 10:29

Sample: 1960 2017

Included observations: 58

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POPULATION	0.000145	1.16E-05	12.54840	0.0000
C	-1529.416	305.5033	-5.006217	0.0000
R-squared	0.737659	Mean dependent var	2071.578	



Adjusted R-squared	0.732974	S.D. dependent var	1544.419
S.E. of regression	798.0721	Akaike info criterion	16.23615
Sum squared resid	35667464	Schwarz criterion	16.30720
Log likelihood	-468.8483	Hannan-Quinn criter.	16.26382
F-statistic	157.4622	Durbin-Watson stat	0.207216
Prob(F-statistic)	0.000000		

COINTERGRATION TESTS

NIGERIA

Table 4.1.0

Date: 12/06/18 Time: 16:28

Series: GDP_PER_CAPITA__\$ POPULATION

Sample: 1960 2017

Included observations: 58

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$	-2.258795	0.6631	-12.28707	0.4641
POPULATION	-1.243465	0.9617	-6.102884	0.8780

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C	POPULATIO
	APITA__\$	N
Rho - 1	-0.171145	-0.078328



Rho S.E.	0.075768	0.062992
Residual variance	46783.61	5.56E+12
Long-run residual variance	76892.99	1.08E+13
Number of lags	1	1
Number of observations	56	56
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution

Table 4.1.1

SOUTH AFRICA

Date: 12/06/18 Time: 16:31

Series: GDP_PER_CAPITA__\$_ POPULATION

Sample: 1960 2017

Included observations: 58

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$_	-3.958429	0.0495	-30.48470	0.0092
POPULATION	-2.543948	0.5156	-9.849425	0.6337

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C	POPULATIO
	APITA__\$_	N
Rho - 1	-0.288108	-0.078933
Rho S.E.	0.072784	0.031028



Residual variance	130360.8	1.43E+10
Long-run residual variance	465396.2	7.10E+10
Number of lags	1	1
Number of observations	56	56
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution

Table 4.1.2

ETHIOPIA

Date: 12/06/18 Time: 16:35

Series: GDP_PER_CAPITA__\$ POPULATION

Sample: 1981 2017

Included observations: 37

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$	-2.134887	0.7288	-9.478636	0.6400
POPULATION	-2.783793	0.4073	-10.88830	0.5323

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C	POPULATIO
	APITA__\$	N
Rho - 1	-0.156109	-0.178281
Rho S.E.	0.073123	0.064042
Residual variance	861.7248	1.10E+11



Long-run residual variance	2593.397	3.35E+11
Number of lags	1	1
Number of observations	35	35
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution

Table 4.1.3

EGYPT

Date: 12/06/18 Time: 16:37

Series: GDP_PER_CAPITA__\$_ POPULATION

Sample: 1965 2017

Included observations: 53

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$_	-2.681524	0.4464	-882.9652	0.0001
POPULATION	-0.517194	0.9956	42.02805	0.9999

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C APITA__\$_	POPULATIO N
Rho - 1	-0.228902	-0.037331
Rho S.E.	0.085363	0.072180
Residual variance	29315.26	3.09E+11
Long-run residual variance	1.68E+08	1.51E+14



Number of lags	1	1
Number of observations	51	51
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution

Table 4.1.4

KENYA

Date: 12/06/18 Time: 16:39

Series: GDP_PER_CAPITA__\$_ POPULATION

Sample: 1960 2017

Included observations: 58

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$_	-1.832837	0.8425	-7.723087	0.7818
POPULATION	-2.186949	0.6980	-6.751359	0.8422

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C APITA__\$_	POPULATIO N
Rho - 1	-0.078912	-0.068795
Rho S.E.	0.043054	0.031457
Residual variance	1759.488	1.06E+11
Long-run residual variance	5374.122	3.25E+11
Number of lags	1	1



Number of observations	56	56
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution

Table 4.1.5

SUDAN

Date: 12/06/18 Time: 16:42

Series: GDP_PER_CAPITA__\$_ POPULATION

Sample: 1960 2017

Included observations: 58

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$_	-0.044908	0.9992	-0.130479	0.9992
POPULATION	-2.102356	0.7371	-4.588258	0.9432

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C	POPULATIO
	APITA__\$_	N
Rho - 1	-0.002190	-0.057483
Rho S.E.	0.048758	0.027342
Residual variance	14316.22	5.31E+10
Long-run residual variance	16210.53	1.08E+11
Number of lags	1	1
Number of observations	56	56



Number of stochastic trends** 2 2

**Number of stochastic trends in asymptotic distribution

Table 4.1.6

MOROCCO

Date: 12/06/18 Time: 16:45

Series: GDP_PER_CAPITA__\$_ POPULATION

Sample: 1960 2017

Included observations: 58

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$_	-2.340596	0.6217	-9.412241	0.6650
POPULATION	-1.938789	0.8050	-7.002227	0.8273

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C APITA__\$_	POPULATIO N
Rho - 1	-0.142776	-0.055591
Rho S.E.	0.061000	0.028673
Residual variance	13981.20	3.44E+09
Long-run residual variance	19375.03	1.74E+10
Number of lags	1	1
Number of observations	56	56
Number of stochastic trends**	2	2



**Number of stochastic trends in asymptotic distribution

Table 4.1.7

LIBYA

Date: 12/06/18 Time: 16:47

Series: GDP_PER_CAPITA__\$ POPULATION

Sample: 1990 2017

Included observations: 28

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$	-2.620538	0.4982	-13.68187	0.3047
POPULATION	-1.221359	0.9682	-3.480064	0.9756

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C APITA__\$	POPULATIO N
Rho - 1	-0.589363	-0.143659
Rho S.E.	0.224902	0.117622
Residual variance	5005420.	2.62E+09
Long-run residual variance	3990420.	2.27E+09
Number of lags	1	1
Number of observations	26	26
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution



Table 4.1.8

Angola

Date: 12/06/18 Time: 17:08

Series: GDP_PER_CAPITA__\$ POPULATION

Sample: 1980 2017

Included observations: 38

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$	-2.483421	0.5570	-23.94869	0.0311
POPULATION	-1.793179	0.8590	-28.37822	0.0078

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C APITA__\$	POPULATIO N
Rho - 1	-0.163945	-0.113369
Rho S.E.	0.066016	0.063222
Residual variance	4271561.	4.99E+10
Long-run residual variance	70331460	2.41E+12
Number of lags	1	1
Number of observations	36	36
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution



Table 4.1.9

Algeria

Date: 12/06/18 Time: 17:10

Series: GDP_PER_CAPITA__\$ POPULATION

Sample: 1960 2017

Included observations: 58

Null hypothesis: Series are not cointegrated

Cointegrating equation deterministics: C @TREND

Fixed lag specification (lag=1)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
GDP_PER_CAPITA_				
__\$	-2.085118	0.7448	-8.493076	0.7298
POPULATION	-1.758077	0.8659	-8.845928	0.7052

*MacKinnon (1996) p-values.

Intermediate Results:

	GDP_PER_C APITA__\$	POPULATIO N
Rho - 1	-0.132008	-0.031197
Rho S.E.	0.063310	0.017745
Residual variance	121205.5	5.56E+09
Long-run residual variance	159983.7	1.43E+11
Number of lags	1	1
Number of observations	56	56
Number of stochastic trends**	2	2

**Number of stochastic trends in asymptotic distribution



5.0 Discussion of findings and conclusions

Findings on analyzing hypothesis one

For the first hypothesis which states that population growth has no significant effect on economic growth one can see the significant levels differ from country to country. The adjusted R2 moderates the R2 indicating that there may be other variables other than our explanatory variables that might have an impact on the dependent variable but not represented in the equation. But since the differences between the R2 and adjusted R2 are not up to 1% for all the countries it means that those variables not represented in the equation bear little impact capable of doubting the results. These two values (R2 & adjusted R2) indicates that the regression line approximates the real data points and so is a very good fit and also shows how well observed outcomes in the analyses are replicated in the model.

For countries like Morocco, South Africa, Egypt and Kenya with an R2 of 89.2%, 85.1%, 83.9% and 81.2% it means that there very significant and positive effects of the population on the income per capita for the years under study (58 years). In these countries it was obvious looking at the charts 4.7, 4.2, 4.4 and 4.5 for the aforementioned countries respectively, one would notice that the there was a near even population increase annually for the period under study. However, the GDP per capita for the said countries were by far the fastest meaning that there is a very high and significant impact on the economic growth by population. It means that these countries have high resource utilization and with steady but not excessive population growth. What this means is that unemployment is not as high as in many other countries.

For countries like Algeria, Sudan, Nigeria and Angola the R2 is 73.7%, 65%, 63.2% and 63.2% respectively, though positive and significant, the impact of population of the GDP per capita is not as high as countries like South Africa. Also a look at the charts on 4.1 for Nigeria shows that the population is growing at a faster rate than the GDP per capita on the average for the period under review a recipe for higher unemployment and lower wages. And because over 80% of the export earnings of Nigeria is dependent on crude oil sales unless the enormous economic potentials at its disposal can be unlocked by diversification the unemployment and underpaid wages may continue. Countries like Algeria, Sudan and Angola have a smaller population and an equally high population impact on GDP per capita and just as Nigeria they are oil producing countries. But Nigeria having almost 30% of the entire population of the ten countries under study stands a greater risk at higher unemployment unless they grow their economy through diversification.

Ethiopia and Libya has an R2 of 45.7% and 16.9% respectively. A clear indicator that changes in the GDP per capita are not so much as a result of population growth. With Ethiopia having 16% of the population under study as against Libya's 0.98% means that Libya's population as small as it is has little impact on growing its economy. Unlike Ethiopia the Libyan economy is not as diversified as they



rely hugely on oil export earnings (Onoh et al , 2018). But both countries levels of GDP per capita is above the continent’s average. But with Libya’s small population and rich reserves the country’s infrastructure development and provision of social amenities should be easier if political stability permits (see charts 4.3 and 4.8).

The Durbin Watson statistics shows a positive serial correlation for all the countries under consideration. The difference between AIC, or Schwarz criterion is negligible, an indicator of a near perfect model convergence near zero. The smaller they are the better the fit of your model is (from a statistical perspective) as they reflect a trade-off between the lack of fit and the number of parameters in the model. The tests to detect the possible presence of unit root in the time series data set was done. This was necessary because we wanted to ensure that the parameters estimated are stationary time series data. The Augmented Dickey – Fuller (ADF) was utilized to test the no presence of stationarity since the ADF Statistics is less than the critical values at 1%, 5% and 10%. that the data are non – stationary, the ADF statistics must be negative than the critical values significant.

The decision is to reject the first hypothesis which postulates that population growth has no significant effect on economic growth

Findings on analyzing hypothesis two

For the second hypothesis which postulates that there is no significant causal relationship between population growth and economic growth measured by GDP per capita income. For each of the ten countries under study, granger causality method was used to see if there was unidirectional causality or bilateral causality.

Table 5.1

Country	Direction of Causality	F-value	P-values	Decision
Nigeria	POP doesn’t granger cause GDP per capita	2.47	0.09	Reject
	GDP per capita doesn’t granger cause POP	1.52	0.22	Reject
South Africa	POP doesn’t granger cause GDP per capita	6.09	0.00	Do not reject
	GDP per capita doesn’t granger cause POP	13.42	2.00	Reject
Ethiopia	POP doesn’t granger cause GDP per capita	5.64	0.00	Do not reject
	GDP per capita doesn’t granger cause POP	1.42	0.25	Reject
Egypt	POP doesn’t granger cause GDP per capita	2.37	0.10	Reject
	GDP per capita doesn’t granger cause POP	6.25	0.00	Do not reject



Kenya	POP doesn't granger cause GDP per capita	1.97	0.15	Reject
	GDP per capita doesn't granger cause POP	1.49	0.24	Reject
Sudan	POP doesn't granger cause GDP per capita	2.25	0.12	Reject
	GDP per capita doesn't granger cause POP	5.15	0.01	Do not reject
Morocco	POP doesn't granger cause GDP per capita	2.88	0.07	Reject
	GDP per capita doesn't granger cause POP	11.62	7.10	Reject
Libya	POP doesn't granger cause GDP per capita	2.61	0.09	Reject
	GDP per capita doesn't granger cause POP	6.50	0.01	Do not reject
Angola	POP doesn't granger cause GDP per capita	4.62	0.02	Do not reject
	GDP per capita doesn't granger cause POP	0.27	0.76	Reject
Algeria	POP doesn't granger cause GDP per capita	1.47	0.24	Reject
	GDP per capita doesn't granger cause POP	49.5	1.02	Reject

The findings are that for each of the two variables (economic growth and population) there were cases of uni-directional causality and bi-directionality. By using the two variables and the attendant higher differences with two lags which enhanced the model's explanatory power, there is sufficient to reject the null hypothesis for the ten countries under review. For countries like Nigeria, Kenya, Morocco and Algeria there were cases of bi-directional causality. This was because a look at table 5.0 shows that the P-value was more than 0.05 ($P > 0.05$) for both variables. South Africa, Ethiopia, Egypt, Sudan, Libya and Angola there were cases of uni-directional causality since their P-value were either above or below 0.05 for the two variables in either direction. Consequently, the magnitude and directionally generally supports that the null hypothesis which says that there is no significant causal relationship between population growth and economic growth measured by GDP per capita income be rejected.

Findings on analyzing hypothesis three

For the third hypothesis which said that there is no long run relationship between population and economic growth was rejected. It was evident judging from the R2 and adjusted R2 that over a long period of 57 years for the ten countries which happen to be the countries with the highest GDP in Africa that with the exception of Libya and Ethiopia all other countries witnessed significant changes in the GDP per capita as population increased. The effects on employment and inflation varied in different proportions from country to country. The cointegration analysis performed for each of the ten countries overwhelmingly supports the position to reject the null hypothesis which said that no long run relationship between population and economic growth.

Table 5.2



Country	Variables	Long-run residual variance	Rho-1	Rho S.E.	Decision
Nigeria	GDP per capita	76892.99	-0.171145	0.075768	Reject
	Population	1.08E+13	-0.078328	0.062992	Reject
South Africa	GDP per capita	465396.2	-0.288108	0.072784	Reject
	Population	7.10E+10	-0.078933	0.031028	Do not reject
Ethiopia	GDP per capita	2593.397	-0.156109	0.073123	Reject
	Population	3.35E+11	-0.178281	0.064042	Reject
Egypt	GDP per capita	29315.26	-0.228902	0.085363	Reject
	Population	1.51E+14	0.085363	0.072180	Reject
Kenya	GDP per capita	1759.488	-0.078912	0.043054	Do not reject
	Population	1.06E+11	-0.068795	0.031457	Do not reject
Sudan	GDP per capita	16210.53	-0.002190	0.048758	Do not reject
	Population	1.08E+11	-0.057483	0.027342	Do not reject
Morocco	GDP per capita	19375.03	-0.142776	0.061000	Reject
	Population	1.74E+10	-0.055591	0.028673	Reject
Libya	GDP per capita	3990420.	-0.589363	0.224902	Reject
	Population	2.27E+09	-0.143659	0.117622	Reject
Angola	GDP per capita	70331460	-0.163945	0.066016	Reject
	Population	2.41E+12	-0.113369	0.063222	Reject
Algeria	GDP per capita	159983.7	-0.132008	0.063310	Reject
	Population	5.56E+09	-0.031197	0.017745	Do not reject

6.0 Recommendations

It has been seen the importance of population to economic growth, the various African governments need to improve technology for increased production. African nations should adopt policies to control their respective population in relation to their economic resources otherwise their youth dependency ratio and unemployment would continue to pose problems in growing their economies. Again increasing savings and investments and applying them to productivity can increase export earnings and reduce unemployment hence raising GDP per capita. With an enhanced value in domestic currency this will boost international trade and the nations foreign reserves. There should be more effort at economic cooperation by African countries to put their labour, technology and exports at a competitive



edge. Given the fact that most of the countries under study are not very diversified in their economic activities as the more developed western and Asian countries the future of increased GDP per capita in relation to the growing population is bleak and they should find a collective response to this common problem.

References

Aguirre, M. S. (2007) —Population Resources and Environment: A Survey of the Debate“, The Catholic Family and Human Right Institute.TheCatholic University of America.

Caldwell J.C (2002). The Theory of Fertility Decline. Academic Press, New York.

Caldwell, John C. I. O. Oruboloye, and Pat Caldwell (2006). Fertility Decline in Africa: A new type of transition? Population and Development Review 9new York) 1vol.8,No.2, pp. 211-242.

Central Bank of Nigeria Statistical Bulletin 2008.

Coale, A. J and Hoover, E. A (2007). Population Growth and Economic Development in Low-income Countries. Princeton, New Jersey; Princeton University Press.

Damoder, N. Gujarati (2003) —Basic Economics“. Tata McGraw-Hill Book Company Limited, New York.

Dawson, P.J. and Tiffin, R., 1998. Is there a long-run relationship between population growth and living standards? The case of India. Journal of Development Studies, 34(5), pp. 149-156.

Easterlin, R. A. and E. M. Crimmins (2001). The Fertility Revolution: A Supply-Demand Analysis. Chicogo: University of Nigeria Chicago Press.

Federal Ministry of Healh (1998). National Policy on population for Development, Unity, Progress and Self-reliance. Federal Ministry of Health, Lagos, Nigeria.



Furedi, F. (2004) —Population and Development: A Critical Introduction“ In Aguirre, M.S. ed population, Resources and Development.

Ibeahim, Mantu (2001). Implications of population Growth fore the Nigeria Economy and Environmental. Olive de L’ Afrique Consult Abuja

Lesthaeghe, R. (2005). Reproduction and Social Organization in Sub-Saharan Africa. Berkeley; University of California Press, Berkeley.

Macunovich, J. Diane (2000). Relative Cohort Size: Source of a unifying theory of global fertility transition? Population and Development Review, vol.26,No.20 pp.235-261.

Michael, P. Todaro, Stephen C. Smith (2003). Economic Development, Pearson Education (Singapore) etc. Ltd, India Branch.

Mohammad Jalal Abbasi – Shavazi and G. W. Jones (2001). Socio-Economic and Demographic Setting of Muslim populations.

National population Commission (2000). Nigeria Demographic Health survey 1999. Calverton, Maryland: National population Commission and ORC/Macro.

Nwosu C, Dike A.O & Okwara K.K (2014). The Effects of population Growth on Economic Growth in Nigeria, The International Journal of Engineering and Science (IJES), Volume 3, Issue 11, pages7-18

Ogujiuba, Kanayo (2005). Challenges of population Dynamics in Nigeria: Implications of Household’s Portfolio Choices. Department of Economics, University of Nigeria.

Oladosu, Muyiwa (2001). Prospects for Fertility Decline in Nigeria: Comparative Analysis of the 1990 and 1999 NDHS data.

Taylor and Francis, (2008). Consequences of Rapid population Growth in Developing Countries. New York Inc.

United Nations (2006). World population Prospects. The 1998 Revision Comprehensive Tables. Vol.1, New York

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United States of America, Bureau of the Census (2001). The International Data Base (IDB)