IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IMPACT OF POPULATION GROWTH ON ECONOMIC GROWTH OF TANZANIA

[1]Dr. Cairo Paul Mwaitete, [2]Patrick Robert

[1] Lecturer, [2] MSc-Finance and Investment student

[1]Department of Accounting and Finance

[1]Institute of Accountancy Arusha, Arusha, Tanzania

Abstract: *This study investigates the impact of population growth on economic growth of Tanzania using granger causality and cointegration. Time series data for the period of 1991 to 2019 were used to validate the findings on granger causality and cointegration. Data were obtained from the World Bank, and were processed using Stata software. Vector error correction model was applied to examine the long run and short run causality. The study is of interest that population in Tanzania has been rising steadily, however the same could not be asserted on economic growth as the economy maintained a cyclical growth, therefore making pronouncements that economic growth prospects in Tanzania is a result of its growing population has been a challenge. The study reveals that there is cointegration between population growth, inflation and economic growth. Moreover, in the short run and long run population growth and inflation has causality impact on economic growth. Based on the findings the study recommends that the government should encourage population growth with caution. They have to make sure that the population is well educated to equip them with capability to engage into economic activities through consumption, investment, employment opportunities and exploitation of resources wisely. Furthermore, the government should carefully design a population growth strategy combined with institutional and policy changes to ensure population growth becomes beneficial to the country. On top of that, the government should also ensure that the economy is growing at a higher rate than the growth of population. This will ensure that the increased demand for goods and services generated by population growth is met.*

Key words: *Granger Causality, Cointegration, Population Growth, Inflation, Economic growth*

I. INTRODUCTION

Agwanda and Amani (2014) noted that, the impact of population growth on economic growth has long been debated ever since Malthus's pioneering work in 1798. Malthus (1798) pointed out that population tends to increase geometrically, while food supplies only grow arithmetically. According to Malthus, higher economic growth stimulates population growth while higher population growth depresses economic growth through diminishing returns (by reducing output per capita). According to Malthusian theory, a high population growth is associated with food problem (malnutrition and hunger), however Bloom and freeman (1998) rejected the theory pointing out that food problem relates to the problem of poverty and insufficient income as opposed to high population growth. From Malthus, two groups emerged the revisionist (optimist), who suggest that, larger population increases demand for goods and services and thus stimulates technological advancement which in-turn increases labour productivity, income per capita and living conditions (Klasen and Nestmann 2006) and the neutral who believe that population growth is a neutral factor in economic growth and is measured outside of conventional growth models (Thornton 2001; Bloom et al 2010).

In Tanzania, population has been rising steadily, however the same could not be asserted on economic growth, as the economy maintained a cyclical growth. It is therefore difficult to pronounce that economic growth prospects in Tanzania is a result of its growing population. Furthermore, justifying the pronouncements has been difficult as no any researcher from Tanzania have used time series data with causality approach to find out the impact of population growth on economic growth. Additionally, existing theories does not provide a clear-cut generalization as to the impact of population growth on economic growth of developing nations such as Tanzania (Garza-Rodriguez et al, 2016). Therefore, the real impact of population growth on economic growth in developing countries such as Tanzania, has continued to be a puzzle.

In solving the puzzle, this study used time series data covering the period 1991 to 2019 and applied causality approach on the same period to find out the impact of population growth on economic growth of Tanzania, and examine short run and long run relationship. Johansen Co-integration model of estimation assisted the researcher in finding the relationship between the two variables.

1.1 Objectives

The main objective of the study is to assess the impact of population growth on economic growth of Tanzania.

Specific Objectives

- To ascertain the magnitude of impact of population growth on economic growth.
- To investigate causal relationship between population growth and economic growth.
- To determine whether long run relationship exist between population growth and economic growth.

1.2 Hypothesis

The study is guided by the following key hypotheses;

- Population growth has no significant impact on economic growth
- There is no causal relationship between population growth and economic growth.
- There is no long run relationship between population growth and economic growth.

II. LITERATURE REVIEW

2.1 Theoretical literature review

Population growth theories includes Malthusian theory, Marxist theory, Boserup theory and Liberal theory.

According to Malthus (1798), population tends to increase at a faster rate than their food supply. While population is growing at a geometrical rate production capacity or food is only increasing arithmetically. The theory claimed that, population growth is expected to lower per capita production, as demand growth cannot keep pace with population growth. Malthus pointed out two checks to maintain a natural balance of population and avoid a stand-still, the preventive checks consisting of voluntary restrictions on population growth i.e. fertility reduction and the positive checks which are a direct result of lack of preventive control. If the society does not actively restrict population growth, illness, famines and wars will reduce size of population and provide balance with resources i.e. Mortality rates (Chang et al 2013).

Marxist theory (1848) claimed that rapid population growth enables economies of scale and encourages technological advances that will inevitably promote growth. Karl Marx went a step further and argued that the unequal distribution of wealth and its accumulation by capitalists caused hunger. It has absolutely nothing to do with the community (Maganga and Omwenga 2018). Marxist totally rejected the Malthusian theory as it did not fit in the socialist economy.

Boserup theory (1965), suggested that, population growth is an autonomous factor that affects rather than being affected by agricultural productivity as suggested by Malthusian theory. The study argued that Malthus prediction of declining labour returns was not long-term, as higher populations could lead to a more productive division of labour and better agricultural practices. The study concluded that soil fertility should not be treated as fixed and nature-given, but can be enhanced by replacing agricultural technology with a better one, which is likely to result from population increase. Simon (1977) in support of Boserup theory noted that because of the above opportunities, growth tend to have a positive effect on the standard of living.

The liberal (neutralist) theorist claim that the population itself has no positive or negative effect on economic growth, leaving all factors constant. Contemporary empirical research on the subject either favoured the optimists or the pessimists, but the opinion of the neutralists remained largely unfounded (Hamza 2015).

The theories of economic growth include Solow Model, Schumpeter's model, Endogenous growth theory and Harrod-Domar Model.

Solow model (1956) viewed the population as an exogenous variable, and thought that population growth generally followed an arithmetic trend rather than a geometrical pattern. According to the model country's economic production (output) is as a result of capital and labor inputs, coupled with technological change. The standard production function used indicates that economic output depends on the amount of labor, capital inputs and the degree of technological advancement.

Schumpeter model (1934), Contrary to the classics, the model did not regard capital accumulation as the main driving force behind economic growth. He attributed great importance to the entrepreneur-innovator concept. In his view, entrepreneurs' innovation and creativity determined economic development. After an innovation has been launched, an inventor earns great profits, but over time the competition copies the invention, and the profits begin to decline.

Endogenous growth theory (1980) the theory argues that; economic growth is induced not by external forces but by forces within a system. In particular, it argues that economic growth is the result of human capital policies, internal processes and investment. Therefore, a country's economic growth on the basis of endogenous growth is due to government policies that promote innovation, investment in human capital, and information development that constitutes internal technology that drives economic growth.

Harrod-Domar Model (1939), suggests that economic growth rates depend on savings levels (higher savings for higher investment) and capital-output ratios. A lower ratio of capital output means more efficient investment, and a higher rate of growth. A simpler Harrod-Domar model is given as; Rate of economic growth (g) $\frac{\text{Level of savings (s)}}{\text{Capital-output ratio (k)}}$. Level of savings (s) = Average propensity to save (APS) – Which is the national savings ratio to the national income. The capital-output ratio = $\frac{1}{\text{marginal product of capital}}$. The capital-output ratio is the amount of capital required to increase production. A high return on capital means low investment. The capital output ratio also has to take into consideration the depreciation of existing capital

The theories of inflation include the quantity theory of money, demand pull theory, cost push theory and structural inflation theory.

Quantity theory of money (QTM). This theory is one of the oldest economic theories. Simply put, it states that changes in the general level of prices are primarily determined by changes in the quantity of money in circulation. (Totonchi 2011). According to QTM money supply is directly proportional to price level in an economy, therefore when supply of money changes price level changes and vice-versa. It is supported by fisher equation; MV = PT, where M is money in circulation, V is velocity of money, P is price level and T is the volume of transactions in the economy. (Hunte 2012).

Demand pull theory. The theory states that aggregate demand is the major cause of demand-pull inflation. Aggregate demand is made up of investment, consumption and government expenditure. When aggregate demand is greater than aggregate supply at full employment level, then demand pull inflation arises. The larger the gap, the more rapid the inflation (Dmitrieva and Ushakov 2011).

Cost push theory. The theory asserts that inflation occurs when costs of production increase. Increase in costs of production or operations is mainly due to increase in wages, increase in cost of raw materials or increased cost of imported components. (Dmitrieva and Ushakov 2011).

2.2 Empirical literature review

Nwosu et al (2014) use annual time series data to investigate the relationship between population growth and economic growth in Nigeria from 1960 to 2008. The researchers used OLS regression and the granger test for causality. The findings indicate a positive relationship between population growth and economic growth in Nigeria. The author is not talking about the impact of population growth on economic growth from the context of Tanzania though the author used time series data with granger causality to justify the findings.

Akintunde et al (2013) used five-year average to analyse the relationship between population dynamics and economic growth in sub-Saharan African countries from 1975 to 2005. The researchers used both pooled OLS and dynamic panel techniques on data collected in the sub-Saharan countries from thirty-five (35) countries. The findings of empirical research showed that high fertility rates have an inverse impact on economic growth while life expectancy at birth has been shown to have a positive relationship with economic growth over the period considered. The researcher never used granger causality and cointegration and also the author is not talking about the impact of population growth on economic growth from perspective of Tanzania. In the 35 countries, Tanzania was not selected.

Rutger and Jeroen (2011) studied the impact of population dynamics (age-structure) in developing countries from 1997 to 2008 on economic growth. The study result showed a strong positive effect on GDP growth rate from working population. The authors never used granger causality and cointegration

Bloom et al (2010) analysed empirically the relationship between aging population and economic growth in Asia between 1960 and 2005, using both descriptive statistics and a fixed (dynamic) panel regression model. The study findings include an inverse relationship between aging population and economic growth; a positive relationship between economic growth and capital stock, openness to trade and other institutional variables included in the regression model. The study never used granger causality and cointegration, and was not talking about population growth mainly from Tanzania that appear to be outside of the scope of the study.

Kothare (1999) aimed at developing the relationship between population growth and India's economic growth in all of India's provinces from 1988 to 1998. The study used the combination of descriptive and empirical statistical tools on the data gathered from various parameters of interests. The study result showed that during the timeframe examined, population growth substantially and positively impacted economic growth. The study never used granger causality and cointegration, and was not talking about population growth mainly from Tanzania.

Hamza (2015) found a negative relationship between population parameters and developing countries' economic growth. Population parameters includes birth rates, death rates and net migration; in the parameters only death rates were statistically insignificant. The study analysed data from 30 developing countries that were selected from Africa, Asia and Latin-America over a 14-year period (2001-2014). The study was not talking about population growth from Tanzania's perspective.

For the period 1950-2007, Furuoka (2010) examined the relationship between population growth and economic growth in Philippine. The study employed OLS technique and found that in Philippine, economic development has a positive impact on population growth. The study shows a unidirectional causality in Philippines from economic development to population growth. The study never used granger causality and cointegration, and was not talking about population growth mainly from Tanzania.

Klasen and Lawson (2007) combined macro and micro-econometric approach to analyse the relation between population and per capita economic growth, and poverty in Uganda using panel data. The study findings indicate that both theoretical implications and solid empirical evidence suggest that the current high population growth in Uganda places a significant break on prospects for per capita growth. In addition, it contributes significantly to low poverty reduction achievement, and is correlated with persistently poor households falling into poverty. Consequently, this is likely to make significant improvements in poverty reduction, and per capita growth quite difficult. The study was not talking about population growth from the context of Tanzania.

Aidi et al (2016) by employing granger causality test and using data from 1970-2013 to assess the relationship between population growth and economic growth in Nigeria, concluded that population growth neither granger cause economic growth nor economic growth granger cause population growth during the period under study. The author analyses the relationship from the context of Nigeria and not Tanzania.

III. RESEARCH METHODOLOGY

This section describes the plan and method used in the study. This entails sample of the study, data and their sources, variables used in the study and analytical framework.

3.1 Data and Sources of Data

This study used secondary annual time series data for the period of 1991 to 2019 from World Bank. The data are Gross Domestic Product (GDP) growth rate as a proxy for economic growth, population growth rate and inflation rate.

3.2 Theoretical framework

Variables of the study includes economic growth (proxied by GDP growth rate), population growth rate and inflation.

Kuznets (1973) described the economic growth of a country as the long-term rise in its ability to provide its population with increasingly diverse economic goods. Adewole (2012) supports Kuznets (1973) by noting that economic growth represents an increase in the capacity of a nation to produce goods and services. Rihab et al (2014) stated that Gross Domestic Product (GDP) of the country in one year is used as a measure for economic growth. GDP is the total amount of final goods and services produced within a country in one year.

Population growth refers to increase in the number of people living in a territory or state. In other words, population growth occurs when the number of people inhabiting a territory or state is rising. Population growth rate is the average annual rate of population change over a given period, usually given in percentage. (Sibly and Hone 2002).

Inflation is usually a broad measure, such as the overall rise in prices or the rise in the cost of living in a country. But it can also be more narrowly measured for certain goods such as food stuffs or for services such as haircut, for instance. Regardless of the context, inflation indicates how much more expensive the relevant set of goods and services has become over a given period usually a year. Inflation is measured by consumer price index. (IMF 2020).

3.3 Statistical tools and econometric models

To find out accurately, whether changes in one variable will have an impact on changes on another variables, we need to apply the Granger Causality Test (Granger, 1969). Therefore, to investigates the impact of population growth on economic growth of Tanzania, this study used time series data with causality approach. To test causality, the study adopted Vector Auto Regression (VAR) model.

The model adopted by the researcher is expressed below;

$GDP_t = \beta_1 POP_{t-i} + \beta_2 INF_{t-k} + \mathcal{E}$

$POP_t = \beta_3 GDP_{t-i} + \beta_4 INF_{t-k} + \mu$

$INF_t = \beta_5 GDP_{t-i} + \beta_6 INF_{t-k} + e$

Where GDP_t is Gross Domestic Product at time t (Proxy for Economic growth), POP_t is Population growth at time t, INF_t is Inflation rate at time t, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ are Coefficients, $_{t-i}$ and $_{t-k}$ are Time lags and $\mathcal{E}$, μ, e are Error terms.

Assumption of the model is that, GDPt, POPt and INFt are stationary if they are not stationary, we have to make them stationary to test for granger causality. It is also assumed that ε, μ and e are uncorrelated.

The model was therefore, subjected to a Unit root test using Augmented Dickey fuller test for intercept, model trend and intercept and no trend and intercept.

Johansen test for cointegration was applied in the study to examine whether variables have long-run relationship or are stable overtime, as a result of their different order of integration.

Vector Error Correction Model was applied to determine the speed of adjustment towards equilibrium and lastly diagnostic checking was applied to test for validity of the findings.

IV. RESULTS AND DISCUSSION

This study was guided by the following hypothesis

H_0: Population growth and inflation does not granger cause economic growth of Tanzania

H_1: Population growth and inflation granger cause economic growth of Tanzania.

Assumption of the Model

GDP_t, POP_t and INF are stationary, if they are not stationary, we have to make them stationary so as to test for granger causality. Also, it is assumed that Ɛ, μ and e are uncorrelated.

Decision Criteria for granger test Causality

The study applied VAR model to develop test for granger causality test using STATA and absolute value of test statistics were used in making decision to accept or reject the null hypothesis at 5% level.

4.1 Unit Root Test

Data were based on the time series data for 29 observations covering the period 1991 to 2019 obtained from the World Bank. To assess stationarity, data for economic growth, population growth and inflation were put to a unit root test. The popular Augmented Dickey-Fuller (ADF) was used and results obtained showed that all the variables were valid in the model. The researcher applied hypotheses to guide the study on testing for unit root and the results showed that all the variables were valid in the model.

4.1.1 Economic Growth (GDP_t)

Hypothesis

H_0: Economic Growth has unit root or not stationary

H_1: Economic Growth does not have a unit root or is stationary

Table 4.1: Intercept only

Augmented Dickey-Fuller test for unit root Number of obs = 24

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	-5.781	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0000

D.dddgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddgdp						
L1.	-7.297833	1.262402	-5.78	0.000	-9.950041	-4.645625
LD.	4.682343	1.14219	4.10	0.001	2.282692	7.081994
L2D.	2.860586	.8672076	3.30	0.004	1.038651	4.682522
L3D.	1.440966	.5045982	2.86	0.011	.3808441	2.501087
L4D.	.5258174	.1879598	2.80	0.012	.1309285	.9207063
_cons	-.1926296	.2930784	-0.66	0.519	-.8083645	.4231052

Since the results show that the test statistics is 5.781 which is greater than 3.000 at 5% critical value, we thus reject the null hypothesis and accept the alternative hypothesis that $\mathbf{GDP_t}$ has no unit root or $\mathbf{GDP_t}$ is stationary; the model is also valid at L1.

Table 4.2: Model trend and intercept

Augmented Dickey-Fuller test for unit root Number of obs = 24

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
		Interpolated Dickey-Fuller		
Z(t)	-5.583	-4.380	-3.600	-3.240

MacKinnon approximate p-value for Z(t) = 0.0000

D.dddgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddgdp						
L1.	-7.259064	1.300306	-5.58	0.000	-10.00247	-4.515659
LD.	4.644918	1.177157	3.95	0.001	2.161334	7.128502
L2D.	2.827799	.8951487	3.16	0.006	.9392005	4.716398
L3D.	1.419386	.5217641	2.72	0.015	.3185602	2.520212
L4D.	.5172015	.1945843	2.66	0.017	.1066646	.9277384
_trend	.0143338	.0437293	0.33	0.747	-.0779268	.1065945
_cons	-.4286946	.780408	-0.55	0.590	-2.075211	1.217822

Since the results show that test statistics is 5.583 which is greater than 3.600 at 5% critical value, we therefore reject null hypothesis and accept alternative hypothesis. This implies that $\mathbf{GDP_t}$ has no unit root or $\mathbf{GDP_t}$ is stationary; the model is also valid at L1.

Table 4.3: No trend no intercept

Augmented Dickey-Fuller test for unit root Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.842	-2.660	-1.950	-1.600

D.dddgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddgdp						
L1.	-7.253622	1.241623	-5.84	0.000	-9.852368	-4.654876
LD.	4.645115	1.123603	4.13	0.001	2.293387	6.996843
L2D.	2.8361	.8533581	3.32	0.004	1.050001	4.622199
L3D.	1.428092	.4966239	2.88	0.010	.3886466	2.467538
L4D.	.5214749	.1850146	2.82	0.011	.134235	.9087148

The results show that the test statistics is at 5.842 which is greater than 1.950 at 5% critical value, we thus reject the null hypothesis and accept the alternative hypothesis. This means that **GDP_t** has no unit root or **GDP_t** is stationary and also the model is valid at L1

4.1.2 Population Growth

Hypothesis

H_0: Population Growth has unit root or not stationary

H_1: Population Growth does not have a unit root or is stationary

Table 4.4: Intercept only

Augmented Dickey-Fuller test for unit root Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.196	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0000

D.dddpop	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddpop						
L1.	-1.088797	.2095344	-5.20	0.000	-1.529013	-.6485818
LD.	.4073505	.1491845	2.73	0.014	.0939255	.7207755
L2D.	.6236887	.1495176	4.17	0.001	.3095638	.9378136
L3D.	.317141	.0958315	3.31	0.004	.1158066	.5184755
L4D.	.1164823	.0706508	1.65	0.117	-.0319496	.2649141
_cons	-.0013814	.0034264	-0.40	0.692	-.0085801	.0058173

The results show that test statistics is 5.196 which is greater than 3.000 at 5% critical value, we therefore reject the null hypothesis that population growth is not stationary and accept the alternative hypothesis that **POP_t** is stationary. The model is valid at L1

Table 4.5: Model trend and intercept

Augmented Dickey-Fuller test for unit root   Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.922	-4.380	-3.600	-3.240

MacKinnon approximate p-value for Z(t) = 0.0003

D.dddpop	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddpop						
L1.	-1.110218	.2255578	-4.92	0.000	-1.586104	-.634333
LD.	.4179538	.1567495	2.67	0.016	.0872412	.7486664
L2D.	.6265059	.1536707	4.08	0.001	.302289	.9507228
L3D.	.3242063	.1008685	3.21	0.005	.1113924	.5370202
L4D.	.120822	.0737959	1.64	0.120	-.0348738	.2765179
_trend	-.0001728	.0005506	-0.31	0.757	-.0013346	.0009889
_cons	.0015836	.0100785	0.16	0.877	-.0196803	.0228474

The results show that test statistics is at 4.922 greater than 3.60 at 5% critical value. We therefore reject the null hypothesis and accept the alternative hypothesis. This means that $\mathbf{POP_t}$ is stationary or has no unit root. The model is also valid at L1

Table 4.6: No trend no intercept

Augmented Dickey-Fuller test for unit root   Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.385	-2.660	-1.950	-1.600

D.dddpop	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddpop						
L1.	-1.097438	.20379	-5.39	0.000	-1.523975	-.6709005
LD.	.4138804	.1449975	2.85	0.010	.1103972	.7173636
L2D.	.6220939	.1461342	4.26	0.000	.3162315	.9279562
L3D.	.3197052	.0934891	3.42	0.003	.1240303	.5153801
L4D.	.1178926	.0689915	1.71	0.104	-.0265083	.2622935

The results show that the test statistics is 5.385 which is greater than 1.950 at 5% critical value, we thus reject the null hypothesis that population growth has unit root, and accept alternative hypothesis that $\mathbf{POP_t}$ has no unit root or is stationary. The model is valid at L1

4.1.3 Inflation

Hypothesis

H0: Inflation has unit root or not stationary

H1: Inflation does not have a unit root or is stationary

Table 4.7: Intercept only

Augmented Dickey-Fuller test for unit root   Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.227	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0006

D.dddinf	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddinf						
L1.	-5.165871	1.222035	-4.23	0.001	-7.733271	-2.598471
LD.	3.008668	1.054975	2.85	0.011	.7922468	5.225089
L2D.	1.668162	.7938709	2.10	0.050	.0003011	3.336023
L3D.	.7640546	.4461852	1.71	0.104	-.1733458	1.701455
L4D.	.1753363	.1911792	0.92	0.371	-.2263163	.5769888
_cons	.1608043	.898331	0.18	0.860	-1.726519	2.048128

The results show that test statistics is 4.227 which is greater than 3.000 at 5% critical value, we therefore reject the null hypothesis that inflation is not stationary and accept the alternative hypothesis that $\mathbf{INF_t}$ is stationary. The model is valid at L1

Table 4.1: Model trend and intercept

Augmented Dickey-Fuller test for unit root   Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.043	-4.380	-3.600	-3.240

MacKinnon approximate p-value for Z(t) = 0.0076

D.dddinf	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddinf						
L1.	-5.189268	1.283623	-4.04	0.001	-7.897476	-2.481061
LD.	3.028429	1.107175	2.74	0.014	.6924931	5.364365
L2D.	1.68208	.831128	2.02	0.059	-.0714471	3.435606
L3D.	.7714659	.4663012	1.65	0.116	-.2123437	1.755275
L4D.	.1780999	.199045	0.89	0.383	-.2418484	.5980481
_trend	.0122792	.1360797	0.09	0.929	-.2748238	.2993822
_cons	-.042422	2.43442	-0.02	0.986	-5.178599	5.093755

The results show that test statistics is at 4.043 greater than 3.60 at 5% critical value. We therefore reject the null hypothesis and accept the alternative hypothesis. This means that $\mathbf{INF_t}$ is stationary or has no unit root. The model is also valid at L1

Table 4.2: No trend no intercept

Augmented Dickey-Fuller test for unit root Number of obs = 24

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.340	-2.660	-1.950	-1.600

D.dddinf	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dddinf						
L1.	-5.166942	1.190485	-4.34	0.000	-7.658656	-2.675227
LD.	3.008126	1.027747	2.93	0.009	.8570271	5.159225
L2D.	1.665665	.7732652	2.15	0.044	.0472021	3.284127
L3D.	.7616282	.4344706	1.75	0.096	-.1477291	1.670986
L4D.	.1737648	.1860492	0.93	0.362	-.2156407	.5631703

The results show that test statistics is 4.340 which is greater than 1.950 at 5% critical value, we thus reject the null hypothesis that population growth has unit root, and accept alternative hypothesis that $\mathbf{INF_t}$ has no unit root or is stationary. The model is valid at L1

4.2 Vector Auto Regression Model (VAR Model)

The study tested for VAR model using STATA to assess whether population growth (POP_t) and inflation (INF_t) can cause economic growth (GDP_t). The lags selection criteria advised the researcher to apply 4 lags for these variables to be tested for granger causality and cointegration test

Table 4.10: Vector Autoregression Model

Vector autoregression

Sample:	1995 - 2019	No. of obs	= 25
Log likelihood	= -11.31341	AIC	= 4.025073
FPE	= .0157562	HQIC	= 4.552453
Det(Sigma_ml)	= .0004962	SBIC	= 5.926519

Equation	Parms	RMSE	R-sq	chi2	P>chi2
dddgdp	13	1.35855	0.9200	287.476	0.0000
dddpop	13	.019048	0.8535	145.7041	0.0000
dddinf	13	4.25112	0.8875	197.1598	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dddgdp						
dddgdp						
L1.	-1.618575	.1912758	-8.46	0.000	-1.993469	-1.243681
L2.	-1.182652	.3198409	-3.70	0.000	-1.809528	-.5557748
L3.	-.5243122	.2630138	-1.99	0.046	-1.03981	-.0088147
L4.	-.06666	.1337481	-0.50	0.618	-.3288013	.1954814
dddpop						
L1.	-4.162696	7.991288	-0.52	0.602	-19.82533	11.49994
L2.	.3277518	6.301329	0.05	0.959	-12.02263	12.67813
L3.	17.22113	5.544554	3.11	0.002	6.354008	28.08826
L4.	3.56456	6.337798	0.56	0.574	-8.857296	15.98642
dddinf						
L1.	-.1772168	.0505	-3.51	0.000	-.276195	-.0782386
L2.	-.0844385	.0737368	-1.15	0.252	-.22896	.0600829
L3.	-.0526021	.0609417	-0.86	0.388	-.1720456	.0668414
L4.	-.0639308	.0451205	-1.42	0.157	-.1523654	.0245038
_cons	-.1173905	.1944549	-0.60	0.546	-.4985151	.2637342

Table 4.10: Vector Autoregression Model

dddpop						
dddgdp						
L1.	-.000388	.0026818	-0.14	0.885	-.0056443	.0048683
L2.	.0030078	.0044844	0.67	0.502	-.0057814	.011797
L3.	-.0000709	.0036876	-0.02	0.985	-.0072986	.0071567
L4.	-.0008983	.0018752	-0.48	0.632	-.0045737	.0027771
dddpop						
L1.	.7563689	.1120432	6.75	0.000	.5367682	.9759696
L2.	-.3319778	.0883489	-3.76	0.000	-.5051384	-.1588172
L3.	-.0676699	.0777384	-0.87	0.384	-.2200344	.0846945
L4.	-.2615568	.0888602	-2.94	0.003	-.4357195	-.087394
dddinf						
L1.	.0001724	.000708	0.24	0.808	-.0012153	.0015602
L2.	-.0004403	.0010338	-0.43	0.670	-.0024666	.001586
L3.	-.0002607	.0008544	-0.31	0.760	-.0019354	.001414
L4.	-.0020288	.0006326	-3.21	0.001	-.0032687	-.0007889
_cons	.0006706	.0027264	0.25	0.806	-.004673	.0060142
dddinf						
dddgdp						
L1.	1.477684	.5985306	2.47	0.014	.3045851	2.650782
L2.	2.098672	1.00083	2.10	0.036	.1370806	4.060263
L3.	.8960862	.8230095	1.09	0.276	-.7169829	2.509155
L4.	.0193297	.4185178	0.05	0.963	-.80095	.8396095
dddpop						
L1.	-33.3708	25.00594	-1.33	0.182	-82.38154	15.63994
L2.	66.64501	19.7178	3.38	0.001	27.99883	105.2912
L3.	3.996837	17.34974	0.23	0.818	-30.00803	38.00171
L4.	-12.49045	19.83192	-0.63	0.529	-51.36031	26.3794
dddinf						
L1.	-1.304537	.1580221	-8.26	0.000	-1.614255	-.9948196
L2.	-1.257879	.2307334	-5.45	0.000	-1.710108	-.8056495
L3.	-.9149614	.1906956	-4.80	0.000	-1.288718	-.5412048
L4.	-.5740786	.1411889	-4.07	0.000	-.8508039	-.2973534
_cons	.0999167	.6084786	0.16	0.870	-1.09268	1.292513

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
dddgdp	dddpop	14.025	4	0.007
dddgdp	dddinf	15.362	4	0.004
dddgdp	ALL	41.953	8	0.000
dddpop	dddgdp	7.0067	4	0.136
dddpop	dddinf	16.616	4	0.002
dddpop	ALL	19.58	8	0.012
dddinf	dddgdp	9.1821	4	0.057
dddinf	dddpop	17.607	4	0.001
dddinf	ALL	25.59	8	0.001

4.3 Granger Causality Wald Test

Case One Hypothesis

H_0: Lagged (4) population growth does not granger cause economic growth

H_1: Lagged (4) population growth granger causes economic growth.

The results from table 4.10 shows that the probability value is 0.007 which is less than 0.05 level of significant, therefore we reject the null hypothesis and conclude that lagged (4) population growth causes economic growth

Case Two Hypothesis

H_0: Lagged (4) inflation does not granger cause economic growth

H_1: Lagged (4) inflation granger causes economic growth.

The results show that the probability value is 0.004 which is less than 0.05 level of significant, therefore we reject the null hypothesis and conclude that lagged (4) inflation causes economic growth

Case Three Hypothesis

H_0: Lagged (4) economic growth does not granger cause population growth

H_1: Lagged (4) economic growth granger causes population growth

The results show the probability value of 0.136 which is greater than 0.05 (significant level), therefore we fail to reject the null hypothesis and conclude that lagged (4) economic growth does not granger causes population growth.

Case Four Hypothesis

H_0: Lagged (4) inflation does not granger cause population growth

H_1: Lagged (4) inflation granger causes population growth.

The results show that the probability value is 0.002 which is less than 0.05 level of significant, therefore we fail to accept the null hypothesis and conclude that lagged (4) inflation granger causes population growth

Case Five Hypothesis

H_0: Lagged (4) economic growth does not granger cause inflation

H_1: Lagged (4) economic growth granger causes inflation

The results show the probability value of 0.057 which is greater than 0.05 (significant level), therefore we fail to reject the null hypothesis and conclude that lagged (4) economic growth does not granger causes inflation.

Case Six Hypothesis

H_0: Lagged (4) population growth does not granger cause inflation

H_1: Lagged (4) population growth granger causes inflation.

The results show that the probability value is 0.001 which is less than 0.05 level of significant, therefore we reject the null hypothesis and conclude that lagged (4) population growth granger causes inflation.

4.4 Johansen Test of Cointegration

Johansen Test for cointegration was guided by the following hypothesis

H_0: There is no cointegration among variables

H_1: There is cointegration among variables

Table 4.11: Johansen test for cointegration

Johansen tests for cointegration

Trend: constant Number of obs = 25
Sample: 1995 - 2019 Lags = 4

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	30	-63.776815	.	104.9268	29.68
1	35	-29.711199	0.93447	36.7956	15.41
2	38	-19.31186	0.56480	15.9969	3.76
3	39	-11.313412	0.47264		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	30	-63.776815	.	68.1312	20.97
1	35	-29.711199	0.93447	20.7987	14.07
2	38	-19.31186	0.56480	15.9969	3.76
3	39	-11.313412	0.47264		

When we start at 0 maximum rank it is observed that the trace statistics is 104.9268 which is greater than the critical value of 29.68; we therefore, reject the null hypothesis that there is no cointegration among the variables and we accept the alternative hypothesis that there is cointegration among variables. Also, when there is 1 maximum rank, we observe that trace statistics is 36.7956which is greater than the critical value of 15.41; we thus reject the null hypothesis and accept the alternative hypothesis that there is cointegration among variables. This means that the three variables have long run relationship, they move together in the long run. Therefore, the three variables are cointegrated.

4.5 Vector Error Correction Model (VECM)

Table 4.12: Vector Error Correction Model

Vector error-correction model

Sample: 1996 - 2019 No. of obs = 24
AIC = 3.445845
Log likelihood = 2.649865 HQIC = 4.018831
Det(Sigma_ml) = .0001609 SBIC = 5.60561

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_dddgdp	14	.752504	0.9936	1554.375	0.0000
D_dddpop	14	.018528	0.7716	33.78158	0.0022
D_dddinf	14	5.58523	0.9405	157.9495	0.0000

Table 4.12: Vector Error Correction Model

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_dddgdp						
_ce1						
L1.	-5.858297	.745523	-7.86	0.000	-7.319495	-4.397099
dddgdp						
LD.	2.897269	.6199518	4.67	0.000	1.682185	4.112352
L2D.	1.372593	.4283035	3.20	0.001	.5331334	2.212052
L3D.	.9437085	.2706666	3.49	0.000	.4132118	1.474205
L4D.	.4778958	.1063482	4.49	0.000	.2694571	.6863345
dddpop						
LD.	-37.37478	7.827502	-4.77	0.000	-52.7164	-22.03316
L2D.	11.94201	4.971681	2.40	0.016	2.197695	21.68633
L3D.	20.00895	3.816524	5.24	0.000	12.5287	27.4892
L4D.	26.82805	4.161267	6.45	0.000	18.67212	34.98399
dddinf						
LD.	1.998862	.2771212	7.21	0.000	1.455714	2.54201
L2D.	1.412088	.1998929	7.06	0.000	1.020305	1.80387
L3D.	.8306017	.1164631	7.13	0.000	.6023383	1.058865
L4D.	.4160503	.0612549	6.79	0.000	.2959928	.5361077
_cons	.1356095	.159461	0.85	0.395	-.1769283	.4481474
D_dddpop						
_ce1						
L1.	-.0244932	.0183558	-1.33	0.182	-.0604699	.0114834
dddgdp						
LD.	.0198998	.015264	1.30	0.192	-.0100172	.0498167
L2D.	.012506	.0105454	1.19	0.236	-.0081626	.0331746
L3D.	.002384	.0066642	0.36	0.721	-.0106775	.0154455
L4D.	-.0019093	.0026184	-0.73	0.466	-.0070413	.0032227
dddpop						
LD.	-.0424137	.1927234	-0.22	0.826	-.4201445	.3353172
L2D.	.0364797	.1224093	0.30	0.766	-.2034381	.2763976
L3D.	-.2494856	.0939678	-2.66	0.008	-.4336592	-.0653121
L4D.	-.2793345	.1024559	-2.73	0.006	-.4801443	-.0785247
dddinf						
LD.	.0101903	.0068231	1.49	0.135	-.0031827	.0235633
L2D.	.0078683	.0049216	1.60	0.110	-.0017779	.0175145
L3D.	.0043763	.0028675	1.53	0.127	-.0012439	.0099964
L4D.	.0004568	.0015082	0.30	0.762	-.0024992	.0034128
_cons	-.0014658	.0039261	-0.37	0.709	-.0091608	.0062293

Table 4.12: Vector Error Correction Model

D_dddinf						
_cel						
L1.	4.381489	5.53342	0.79	0.428	-6.463815	15.22679
dddgdp						
LD.	-1.988428	4.601405	-0.43	0.666	-11.00702	7.030161
L2D.	.6045567	3.178953	0.19	0.849	-5.626078	6.835191
L3D.	.4068317	2.008941	0.20	0.840	-3.530621	4.344284
L4D.	.0167985	.7893376	0.02	0.983	-1.530275	1.563872
dddpop						
LD.	86.93817	58.09727	1.50	0.135	-26.9304	200.8067
L2D.	11.72439	36.90081	0.32	0.751	-60.59986	84.04865
L3D.	33.43636	28.327	1.18	0.238	-22.08354	88.95626
L4D.	-20.34956	30.88575	-0.66	0.510	-80.88452	40.18541
dddinf						
LD.	-3.17587	2.056849	-1.54	0.123	-7.207219	.8554796
L2D.	-2.76206	1.483645	-1.86	0.063	-5.669951	.1458303
L3D.	-1.79256	.8644122	-2.07	0.038	-3.486777	-.0983432
L4D.	-1.063156	.4546464	-2.34	0.019	-1.954246	-.1720655
_cons	.1813097	1.183551	0.15	0.878	-2.138408	2.501028

Table 4.12 above shows long run and short run causality among population growth, GDP growth and inflation.

4.6 Long Run Causality

The VECM model shows the long run causality existing between economic growth, population growth and inflation. It shows the coefficient is negative at L1(Cel) i.e. -5.858297 with a probability value of 0.000 which is significant at 5% level. Therefore, we can say that there is long run causality running from population growth and inflation to Economic growth.

There is however no long run relationship running from economic growth and inflation to population growth, because at L1(Cel) though the coefficient is negative (-0.244932), the probability value is 0.182 which is insignificant at 5% level; Also there is no long run relationship running from economic growth and population growth to economic growth because at L1(Cel) the coefficient is positive4.38149 and the probability value is insignificant at 5% level (i.e. 0.428)

4.7 Short Run Causality

The short run causality concept was guided by the following hypothesis;

- H_0: There is no short run causality running from population growth and inflation to economic growth
- H_1: There is short run causality running from population growth and inflation to economic growth

Table 4.13: Test for short run causality

```
 ( 1)  [dddgdp]L.dddpop = 0
 ( 2)  [dddgdp]L2.dddpop = 0
 ( 3)  [dddgdp]L3.dddpop = 0
 ( 4)  [dddgdp]L4.dddpop = 0
 ( 5)  [dddgdp]L.dddinf = 0
 ( 6)  [dddgdp]L2.dddinf = 0
 ( 7)  [dddgdp]L3.dddinf = 0
 ( 8)  [dddgdp]L4.dddinf = 0
 ( 9)  [dddgdp]L.dddgdp = 0
 (10)  [dddgdp]L2.dddgdp = 0
 (11)  [dddgdp]L3.dddgdp = 0
 (12)  [dddgdp]L4.dddgdp = 0

           chi2( 12) =  287.48
         Prob > chi2 =    0.0000
```

Based on the above shot run output it shows that the P-value is 0.000 which is less than 5% significant level and therefore we reject the null hypothesis and accept the alternative hypothesis that there is short run causality running from population growth and inflation to economic growth.

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Population growth impacts economic growth of Tanzania. This is evidenced from the findings that the population growth and inflation granger cause economic growth. It is also revealed that there is cointegration between population growth, inflation and economic growth (at 4 lags). Vector error correction model exhibits that there is long run causality running from population growth and inflation to economic growth similarly there is short run causality running from population growth and inflation to economic growth. The study validates that population growth has significance impact on economic growth of Tanzania given time period. The higher the population growth the higher the economic growth will be attained. Policy makers and government officials needs to develop good policies to utilize the growing and help achieve more economic growth in Tanzania.

5.2 Recommendations

Given the size of the country and available resources, the study reveals that Tanzania still need more people in order to develop. It reveals that population growth granger cause economic growth. The higher the population more consumption for goods and services and hence more industries, jobs, etc. are created to the economy. Therefore, the study recommends the following;

- The government should encourage population growth with caution. They have to make sure that the population is well educated to equip them with capability to engage into economic activities through consumption, investment, employment opportunities and exploitation of resources wisely.
- The government should carefully design a population growth strategy combined with institutional and policy changes to ensure population growth becomes beneficial to the country.
- The government should also take steps to ensure that the economy is growing at a higher rate than the growth of population. This will ensure that the increased demand for services generated by population growth is met. Having a larger, healthier, and better-educated workforce will only bear economic fruit if jobs can be found for additional workers.
- The average growth rate of population in Tanzania should be maintained and the government should make concerted efforts to track the rate of population growth. Any population growth that happens too rapidly would have declining returns or build a situation where economic growth stagnates.

ACKNOWLEDGMENT

First and far most, special appreciations goes to our Almighty God for His grace and everlasting love that enabled us to accomplish this study. Secondly we acknowledge the Institute of Accountancy Arusha for giving us time and facilities to conduct this study and lastly we acknowledge The Nelson Mandela African Institution of Science and Technlogy (NM-AIST) for giving us resources to undertake this study.

REFERENCES

[1] Adewole, A. O (2012), "Effect of population on economic development in Nigeria: A quantitative assessment". *International Journal of Physical and Social Sciences*, Volume 2, No. 5

[2] Agwanda, A. and Amani, H. (2014), Population growth, structure and momentum in Tanzania. Background paper no. 7. The Economic and Social Research Foundation (ESRF).

[3] Aidi, H. O., Emecheta, C and Ngwudiobu, I. M (2016), "Population Dynamics and Economic Growth in Nigeria". *Journal of Economics and Sustainable Development*, Volume 7, No.15.

[4] Akintunde, T. S., Omolola, A. P and Oladeji, I. S (2013), "Population Dynamics and Economic Growth in Sub-Saharan Africa*". Journal of Economics and Sustainable Development.* Volume 4, No. 13

[5] Bloom, D. E and Freeman, B. R (1988), "Economic Development and the Timing and Components of Population Growth". *Journal of Policy Modeling*, Volume 10, No.1

[6] Bloom, D. E., Canning, D. and Fink, G (2010), "Implications of population ageing for economic growth". *Oxford review of economic policy*, Volume 26, No. 4

[7] Boserup, E (1965), The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure. London.

[8] Chang, T. C., Deale, F. W and Gupta, R (2014), "The Relationship between Population Growth and Economic Growth Over 1870-2013: Evidence from a Bootstrapped Panel-Granger Causality Test". University of Pretoria, Department of Economics working paper 2014-31.

[9] Dmitrieva. O and Ushakov. D (2011). Demand-pull Inflation and Cost-push Inflation: Factors of Origination and Forms of Expansion, *Voprosy Economiki*, volume. 3.

[10] Garza-Rodriguez, Jorge., Andrade-Velasco. C. I., Martinez-Silva, K.D., Renteria-Rodriguez, F. D and Vallejo-Castillo, P. A (2016), *The relationship between population growth and economic growth in Mexico.* Volume 36, No.1

[11] Hamza, L (2015), Panel Data Analysis of Population Growth and It Implication on Economic Growth of Developing Countries. *Proceedings of the International Symposium on Emerging Trends in Social Science Research. Chennai-India, paper Id C509*

[12] Harrod. R. F (1939), "An Essay in Dynamic Theory", *Economic Journal*, Volume. 49

[13] Hunte. C. K (2012), The equation of exchange: a derivation. *The American Economist*. Vol. 57, No. 2. Sage Publications, Inc

[14] Thornton, J (2001), "Population Growth and Economic Growth: Long-run Evidence from Latin America". *Southern Economic Journal (IOSR-JHSS)*, Volume.68, No. 2

[15] Kothare, R (1999), The impact of population growth on economic growth in India. Journal of Social Science India, 410, pp.1-14.

[16] Klasen, S and Lawson, D (2007), "The impact of population growth on economic growth and poverty reduction in Uganda". *Diskussionsbeiträge aus dem Volkswirtschaftlichen Seminar der Universität Göttingen*, No. 133

[17] Klasen, S and Nestmann, T (2006), "Population, Population Density and Technological Change", *Journal of Population Economics*, Volume 19, No. 3

[18] Maganga, J. M and Omwenga, J (2018), "Impact of Population Dynamics and Characteristics on the Economic Growth of Kenya", *Journal of Economics*, Volume. 2, No.1

[19] Kuznets, S (1973), "Modern Economic Growth: Findings and Reflections". The American Economic Review, Volume 63, No. 3

[20] Malthus, T (1798), "An essay on the Principle of Population as it Affect the Future Improvement of Society", printed for J. Johnson, in St. Paul's-Yard, London

[21] Nwosu, C., Dike, A. O and Okwara, K. K (2014), "The Effects of Population Growth on Economic Growth in Nigeria". *The International Journal of Engineering and Science (IJES)* Volume 3, No. 11

[22] Sibly, R and Hone, J (2002), "Population growth rate and its determinants: An overview" Philosophical transactions of the Royal Society of London. Series B, Biological sciences. Volume 357, No.70

[23] Simon, J. L (1977), *The Economics of Population Growth*. Princeton University Press: Princeton New Jersey

[24] Solow, R. M (1956), "A Contribution to the Theory of Economic Growth". *The Quarterly Journal of Economics*, Volume.70, No. 1

[25] Schumpeter, J. A (1934), *The Theory of Economic Development,* Cambridge, MA, Harvard University Press

[26] Totonchi, J (2011), Macroeconomic Theories of Inflation. International Conference on Economics and Finance Research. Volume 4. IACSIT Press, Singapore.

[27] Thuku, G. K., Paul, G and Almadi, O (2013), "The Impact of population change on economic growth in Kenya*". International Journal of Economics and Management Sciences*, Volume 2, No 6.