The Implications of Population Growth on Environmental Degradation in Cameroon

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ABSTRACT

This paper is designed to investigate the interrelationship between population growth and environmental degradation and to evaluate the influence of the structure of the economy on the environmental degradation using times series data for 37 years (1980-2016). Using the difference Generalised Method of Moment estimation technique, it is observed that population growth exerts a positive significant influence on the environment and the environment affects population growth negatively over our the period of analysis. Based on the structure of the economy, the agricultural and manufactured valued added positively affect environmental degradation, while the service sector shows a negative influence. Based on the findings, policy measures need to be taken to incorporate environmental concerns into agricultural development, urban planning, technological innovations, industrial growth, and resource management, the degradation of the environment is likely to worsen in the future. For such policy to be effective, special efforts should be made for informing.

Keywords: *Population Growth, Environmental degradation, Composition effect and generalised method of moment.*

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Highlights of this paper

- This study investigates the interrelationship between population growth and environmental degradation and to evaluate the influence of the structure of the economy on the environmental degradation using times series data from 1980 to 2016.
- The results indicate that the agricultural and manufactured valued added positively affect environmental degradation, while the service sector shows a negative influence.

1. INTRODUCTION

The discussion on the interrelation between population growth, and the environment can be trace back to Malthus (1798) whose focal thought was the carrying capacity of food supply. Malthusian theory contends that food production grew arithmetically, while population grew geometrically. The implication is that the earth's capacity to feed its population would one day come to an end. When reaching a certain population limit, natural factors like epidemics and famines or human forces like birth control and contraceptives readjustment mechanisms would automatically take place and reduce the number of people by failing to simultaneously increase food supplies. However, the Malthusian framework ignores the potential for technological progress. Boserup (1965) contended that technology is capable of significantly increasing yields to keep up with increasing demand. This was the initial move towards perceiving the multidimensional aspect of population growth and her perspectives impacted various reports. Barbier (2010) focused on the so-called "population-poverty-environment" nexus by adding the population variable to the poverty-environment link initially put in place by Minot and Baulch (2002).

This debate focuses on the question: 'how far the growing population is to be accused for the environmental problems the world faces today'? Neo-Malthusians emphases the negative impact of population growth. Lester (1989) contending towards this path, points out that our closest enemy, hunger, is again at the door. Glantz (1988) likewise include that the growing population will force agricultural societies in many areas to depend more and more on marginal land for food production. This incited him to make inquiry whether people undertaking land-use activities that the climate cannot support in the long run and hence environmental degradation. Another argument in the debate is provided by anti-Malthusians whoopined that population growth can make positive contribution to economic growth. As indicated by this school of thought, the environmental ills and famine is as a result of inappropriate technology, inequality and exploitations which squeeze poor farmers onto marginal land and force them to overexploit it Harrison (1985). In line with the anti-Malthusians tradition, Skinner (1988) argued that the population by itself does not threaten the quality of life on earth. Rather, problems of distribution and social reforms are at the bottom of Third World environmental crisis in particular.

Following this theoretical pathway, population growth and environmental degradation are a call for concern. The world population is estimated to reach 8.1 billion by 2025 and 9.6 billion by 2050 (United Nation (UN), 2012). Nevertheless, this population growth is expected to take place in the developing world expanding from 5.4 to 7.9 billion, whereas the population of the developed world is expected to remain unchanged at 1.2 billion. Africa, which has the fastest population growth rate of the continents, is anticipated to dramatically increase the quantity of its occupants in the next 43 years —from 965 million to approximately 2 billion (UN, 2007). With this growth, along with the rest of the globe, there will be increased strain on already insufficient resources. Sustained population growth and increased consumption result in intensive exploitation and pressure on resources (UNEP, 2009).

The increase in population growth and development of the world are degrading the environment through the uncontrolled growth in urbanisation and industrialisation, expansion and intensification of agriculture, and the destruction of natural habitats. The pressures on the environment intensify every day as the population grows. The rapid increase in human numbers combines with high poverty and rising levels of consumption are depleting natural resources on which the livelihood of present and future generations depends (Gebretsadik, 2016). The

growing trends of population with the high demand for food, energy, and housing have considerably changed land-use practices and severely degraded the environment. The increasing population put immense pressure on land intensification at cost of forests and grazing lands because the demand for food could not increase significantly to population.

During the past 200 years human influence on the functioning of the earth's systems has reached unprecedented levels especially as people depend heavily on the natural resource base for their basic needs, such as food, energy, water, and housing. Massive burning of fossil fuels and widespread land conversions has altered the global carbon pools. As a result, carbon dioxide concentrations in the environment have expanded by more than 30 percent since 1800 (Gebretsadik, 2016). This will alter agro-environmental conditions and thus affect the suitability and productivity of crops. The damage man is inflicting on the environment is increasingly evident as arable lands are continuously lost to erosion and salinity, desertification, and urban spread, deforestation and loss of biodiversity; and water shortage have turned out to be extraordinary.

Africa's population is expected to increase from 1.01 billion in 2009 to 2 billion in 2050 given the current demographic conditions. Much of this growth will be concentrated in sub-Saharan Africa, where annual population growth rates are expected to range between 1.6 percent and 2.4 percent between 2010 and 2050 (UN, 2011). Inside Africa, significant variations in demographic changes are expected to occur across geographic regions. In East and West Africa, which have Africa's fastest growth rates, projected growth between 2010 and 2050 is expected to occur at rate of about 2.2 percent per year, according to the UN's medium growth rate assumptions. In absolute terms, annual growth rates in East Africa will be systematically followed by those observed in Central (2 percent), North (1.07 percent), and Southern Africa (0.38 percent) (UN, 2011). Althoughpopulation growth rates are expected to decline across world regions, including Africa, in the first half of the twenty-first century, sub-Saharan African countries will still record some of the world's fastest population growth rates during this period. By 2050, for example, eight of the top ten fastest growing countries in the world will be found in the sub-Saharan African region (UN, 2009).

Cameroon with an estimated population of 25.5 million inhabitants as at the end of 2017 is projected to reached 29.5 million inhabitants by 2025 and 32.9 million by 2030 (UN, 2015). The country's urban population has been expanding from 39.7 percent in 1990 to 55.1 percent in 2016 and it is expected to reach 70 in 2030.Cameroon is often a destination for refugees and asylum seekers in the region. In 2007, more than 97,000 refugees moved to Cameroon, most of whom were from the Central African Republic, Chad and Nigeria escaping war. This trend continues, with more than 90,000 additional refugees fleeing to Cameroon from the Central Africa Republic in 2014 at a rate of 2,000 per week. Growth in agricultural sector (Backbone of the economy) is dependent upon the state of the environment, particularly on the country's land and water resources. In Cameroon, the industrial sector is dominated by agro industries which also dependent on the environment. Degradation in Cameroon takes the form of deforestation, land degradation due to erosion, water logging and salinity, use of agrochemicals pollution associated with industrial and domestic activities. Environmental degradation can lead to health related illnesses through prolonged exposure to toxic substances which negatively affects labour productivity through reduction in both the labour force and productive labour hours and thus negatively affecting output.In addition, extreme environmental degradation can lead to permanent loss or reduction in the volume of natural resources which can lead to the closure of resource dependent industries which are core contributors to national output and this would be detrimental to the overall economy. Environmental degradation therefore if not addressed results in both economic and social challenges that hinder the attainment of national goals. However, there have been no exhaustive studies in Cameroon that have been undertaken to determine the nature of the interrelationship between

population growth and the environment, and how the various composition effect (Agricultural, Manufactured and Services sectors) will affect the degradation of the environment. It is in this light that this study is out to fill this gap.

The main objective of this paper is to examine the nature of the interrelationship between population growth and environmental degradation in Cameroon. The specific objectives include to:

- Assess the effects of the structure of the economy on environmental degradation.
- Determine if environmental degradation influences population growth in Cameroon.
- Offer recommendations towards ways of reducing environmental degradation

The paper is therefore organised as follows. After the introduction in Section 1, the review of literature is carried out in Section 2. The methodology of the study is explained in Section 3. Section 4 presents the results and discussion of findings, while Section 5 offers the conclusion and recommendations of the paper.

2. LITERATURE REVIEW

Population growth in this paper will be viewed as the average annual rate of change of population size during a specific period. To Cincotta and Engelman (1997); Karev (2002); Prettner and Trimborn (2012) continuous growth in population of the Less Developing Countries (LDCs) is a curse because a great number of the population is largely dependent and unproductive, part of the population that is trained is relatively insignificant, and the fraction of the population that has capacity to contribute to Research and Development (R&D) is relatively intangible. On the other hand, Adewole (2012); Isola and Alani (2012) argue that population growth is very essential in the development process of LDCs, because labour or human capital is a major component in the production process. They however argue that population is a blessing if a large part of it constitutes a well-trained and informed human capital.

It is important to note that the aspects of the environment that has become a cause of major concern is the depletion of 'natural resources' caused by the human development process. Environmental degradation comes about due to erosion and decline of the quality of the natural environment, caused directly or indirectly by anthropogenic activities that extract various environmental resources at a faster rate than they are replaced, and thus depleting them. Environmental degradation is defined for the purposes of this study as the concentration of a certain pollutant in the environment. However, the concentration of pollutants in the atmosphere may not be just governed by the current level of net emissions but it is history dependent. The concentration of a pollutant in the environment in the present period is equal to net present emission plus the net accumulation of excesses in past periods.

2.1. Population Growth and Environmental Degradation

Population impacts on the environment primarily through the use of natural resources and production of wastes and is associated with environmental stresses like loss of biodiversity, air and water pollution and increased pressure on arable land. The postulate effects of population change on the environment are receiving a great deal of attention from policy makers. Most of this attention stems from a growing popular consensus that high population growth rates in developing countries are adversely affecting the environment (Jolly, 1994). The relationship is however much more complicated. For the neoclassical economist, high population growth is a neutral factor since it has no unbiased effect on the environment. According to them the influence of population growth on the environment depends on whether free market forces are operative. In an efficient market, population growth will induce innovation and the development of technologies. Proponents of this school hold that population growth will

increase demand and force producers to become more efficient. The classical economist argued that population growth is the single factor causing environmental degradation because an increase in population puts pressure on fixed available resources to maintain or increase the population standard of living. Dependency theories state that the relation of developed to developing nations is that of dependence and is explosive off the environment. Intermediate variable theories view population growth as an immediate cause of environmental degradation. The degree to which these causes, such as polluting technologies, damage the environment is intensified by the number of people.

On the other hand, there is ample evidence that environmental degradation can affect the size and distribution of the population. Environmental degradation can affect each of the three demographic processes-fertility, mortality, and migration. Environmental degradation can adversely affect human health, which can, in turn, increase mortality rates and shorten life spans in a population. Environmental degradation can lead to migration, for example, by pushing people off the agricultural lands to other areas as a result of land degradation (Jacobson, 1988). Environmental degradation can also affect fertility by increasing the demand for children to fetch water and fuel wood or manage livestock (Nerlove, 1991; Dasgupta, 1995). Merging these forces is a "vicious cycle" theory.

The literature on "population-environment nexus" is dominated by a large number of studies showing how population affects the environment. Some suggested that rapidly growing population not only increases pressure on marginal lands, over-exploitation of soils, overgrazing, over cutting of wood, soil erosion, silting, flooding but also increases excess use of pesticides, fertilizers, causing land degradation and water pollution (Khan *et al*., 2009). Trainer (1990) expressed that most of the developing countries suffer because of the rapid increase in population, that in turns deplete natural resources, raising air and water pollution, increasing deforestation, soil erosion, over grazing and damage to marine and coastal ecosystem. Three papers study panel data from Thailand (Panayotou and Sungsuwan, 1994; Cropper *et al*., 1999) and India (Foster and Rosenzweig, 2003). Their discoveries distinguish pernicious impacts of population pressure on deforestation, with one exception of Foster and Rosenzweig (2003) who find a positive link between population and forest stocks.

There are few cases in which environmental effects on population growth are considered. Aggarwal *et al.* (2001) and Filmer and Pritchett (2002) who carried out a cross-sectional survey data from South Africa and Pakistan, respectively, generally observed a positive relationship between fuel wood scarcity and fertility.Studies on how the environment affects migration can be seen in the work of Amacher *et al.* (1998) who look at urban-rural migration in the Philippines. They found out that migration tends to be encouraged by the presence of more open-access environmental resources.

2.2. Theoretical Literature

The vicious circle model holds that in the absence of clearly defined and enforced usage of a common pool of resources such as pasture, firewood or fishing resources, people will in general overexploit these resources. Proponents of this model argue that, under certain circumstances, high fertility, poverty, and environmental degradation are closely linked and can combine into asnowball effect of higher population growth, increasing poverty, and an ever-deteriorating environment. This model is link with the study in that, increase in population growth will mount pressure on arable land, increases over-exploitation with the applicability of chemicals like fertilizers, pesticides will reduces soil fertility and deforestation. This decline in environmental quality will intend affect population growth through its parameters like mortality, net-migration and fertility.

The Malthusian Theory of Population examined the relationship between population growth and resources. This theory was based on the assumptions that food is necessary to the life of people and, therefore exercises a

strong check on population, population is necessarily limited by the means of subsistence that is food. Population increases faster than food production whereas population increases in geometric progression (1, 2, 4, 8, 16, 32), food production increases in arithmetic progression (1, 2, 3, 4, 5). Population always increases when the means of subsistence increases, unless prevented by some powerful checks. Preventive checks are voluntary actions people can take to avoid contributing to the population (like late marriages, contraceptives and family planning) while Positive checks to population growth are things that may shorten the average lifespan, such as disease, warfare, famine, and poor living and working environments. This theory is link to the study in that if population remains uncheck, it will mount pressure on the limited arable land through overgrazing, over exploitation and soil erosion.

3. METHODOLOGY

This study covers a period of 37 years (1980 to 2016) because it is within this period that environmental law was introduced and due to the fact that data for the study is available and also because the period is long enough to take care of any reforms that have been put in place with regards to population of Cameroon. This will enable us examine the influence of structural change on the environment and the nature of the causality between population growth and the environment a causal research design. Two models are adopted for this study. The first model captures the influence of population growth on the environment in Cameroon while the second captures the effect of environmental degradation on population growth of Cameroon.

Based on the fact that this study examine how population growth relates to environmental degradation and theories like the vicious circle model explains the existence of the opposite, then our models must contain system equations explaining these variables and showing their interrelationship. The model is based on the basic framework of the Environmental Kuznets Curve, where environmental degradation has indicators such as carbon dioxide emission as a function of the level and squares of per capita income. The GDP per capita is assumed to have a negative effect on environmental degradation based on the volume of carbon dioxide emission. This standard framework of Environmental Kuznets Curve can be seen in the works of Stern (2004). This Equation 1 can be simplified as;

$$ED_t = Ƀ_0 + Ƀ_1 GDP_t + Ƀ_2 GDP^2_t + \varepsilon_1 \quad (1)$$

Where ED_t denotes environmental degradation, GDPt represents the income per capita and GDP^2_t represents the income per capita square. The model was augmented to include other variables based on the Malthusian theory of population and the vicious cycle theory and other empirical studies and also to overcome the problem of omitted variable bias. The vicious cycle theory holds that population density (POP) as a proxy for population growth, and openness to trade (OPEN) are assumed to have an effect on environmental degradation thus they are included in the study. The study uses manufacturing value added (MAN), agricultural value added (AGR) and services value added (SER) sectors as proxies for structural changes to capture the composition effect. Given that the value added in the agricultural, manufacturing and service sector, can better explain the structure of the economy than an aggregated value like GDP. It is then logical to drop the variable GDP. As income grows due to economic growth, the structure of the economy shifts from primary activities that are pollution intensive to activities that are environmental friendly (Copeland and Taylor, 2004).

The model is, therefore, express as:

$$ED_t = \beta_0 + \beta_1 GDP^2_t + \beta_2 POP_t + \beta_3 OPEN_t + \beta_4 MAN_t + \beta_5 AGR_t + \beta_6 SER_t + \varepsilon_3 \quad (2)$$

A priori $\beta_2, \beta_3, \beta_4, \beta_5 > 0$, $\beta_1, \beta_6 < 0$

The study developed a population function from an augmented demographic bookkeeping equation which tries to keep balance between population and resources. This is expressed as Equation 3;

$$POP_t = POP_o + CBR + CDR + NMG \quad (3)$$

Where POP_t is population at time t, CBR and CDR refers to the crude birth rate and crude death rate over the period respectively, POP_0 is population in the past, and NMG is net migration. Due to the availability of consistent data for the variables the equation was augmented and following the natural population growth hypothesis and other empirical works, some variables were excluded even though they are considered of great importance in the explanation of population changes impact, due to the scarce information on them it was decided they should be omitted, such as net migration, female labour force participation and fertility rate.

$$POP_t = \alpha_0 + \alpha_1 ED_t\ \alpha_2 CBR_t + \alpha_3 LEXPt + \alpha_4 IMRt + \alpha_5 LIT + \varepsilon_4 \quad (4)$$

A prior $\alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 > 0, \alpha_5 < 0$.

From Equations 2 and 4, β_0 and α_0 are the constant terms, ε_1 and ε_2 represent the stochastic or error terms with the assumed normality. β_1 to β_6 and α_1 to α_5, are all coefficients of the parameters to be estimated, as stated by the Gauss-Markov theory.There are two types of endogeneity problems which can occur when regressing population growth and environmental degradation that have been ignored by most of previous literature. One type is thesimultaneitybiasintroducedbythereverse causality of population growth and environmental degradation as observed in the literature and the second problem arises from omitted variable bias. In order to go around this problem of endogeneity we implement Instrumental Variable (IV) Generalised Method of Moments (GMM) regression. The GMM system formula is expressed as follows:

$$ED_{(t)} = \alpha ED_{t-1} + POPX'_t + \varepsilon_{t-1} \quad (5)$$

$\varepsilon_i = \mu_i + \theta_i$Where: $ED_{(t)}$= is the dependent variable(ED) at time t, X'_t = I the independent variable (POP) at time t. The error term has two components; μ_i fixed effect and θi diosyncratic shocks. Thedifference GMM approach deals with this inherent endogeneity by transforming the data to remove the fixed effects. The standard approach applies the first difference (FD) transformation, which removes the fixed effect at the cost of introducing a correlation between $\Delta yit-1$ and Δvit, both of which have a term dated (t−1). This technique provides a strategy for estimation in cases where the number of restricted moments in the data generating process is more than the number of parameters to be estimated (Forgha and Mbella, 2016) it allows for over-identified parameters to be estimated which is the case with the equations of this study. According to Hansen (2007) the GMM provides a natural way to construct test which takes accounts of sampling and estimation errors. This technique provides more efficient estimators than common method of moment estimators like OLS and Two-Stage Least Squares under the conditions of heteroskedasticity (Wooldridge, 2001).

The estimated parameters have also been validated based on economic theories, statistical criteria, and the econometric second order condition. The study tests for stationarity properties of the time series data using conventional unit root tests such as the Augmented Dickey and Fuller (ADF) test and the confirmatory Phillips Perron (PP) test.

4. DATA ANALYSIS AND DISCUSSION OF RESULTS

The results of the ADF test and Phillip Perron Test which is not present here because of space indicates that Environmental degradation (ED), agricultural Value added (AGR), infant mortality (IMR) and life expectancy attain stationarity at levels while all the other variables achieve stationarity after first difference, hence they are integrated of the 1(1). The Johansen and Juselius (1990) co-integraded test was conducted which treats all the non-stationary variables as endogenous. The Trace statistics of the test indicates four co-integradating equation. Due to the fact that the environmental law was introduce in 1996 in Cameroon, for the fear that this might altered the

trend of the variable, we implement the chow breakpoint test to see if splitting the regression might give us more accurate results.

Table-1. Chow Breakpoint Test: 1996.

Null Hypothesis: No breaks at specified breakpoints
Equation Sample: 1980 2016

F-statistic	0.807785	Prob. F(12,13)	0.6410
Log likelihood ratio	20.61365	Prob. Chi-Square(12)	0.0563
Wald Statistic	9.693423	Prob. Chi-Square(12)	0.6428

The F-statistic shows that there is no break at the specify breakpoint. Hence having one equation will give us accurate estimates. The endogeneity test was also carry out and the result not presented based on space shows that there is no endogeneity problem. The researchers then proceed to present the result.

Table-2. The GMM result for POP and ED.

Method: Generalized Method of Moments
Instrument specification: ED(-1) D(GDP(-1)) POP D(OPEN(-1)) D(MAN(-1)) AGR D(GDPP(-1)) D(SER(-1)) C

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	0.485284	0.008209	3.643687	0.0032
D(OPEN)	0.044241	0.030548	1.448250	0.1591
D(MAN)	0.324754	0.126976	2.982498	0.0096
AGR	0.860507	0.033296	3.315545	0.0048
D(GDP2)	-4.80E-06	4.84E-06	-0.992039	0.3300
D(SER)	-0.001458	0.080702	-3.018069	0.0057
C	0.257629	0.935205	0.275479	0.7850
R-squared	0.910630	Durbin-Watson stat		1.911535
Adjusted R-squared	0.853978			
F-Statistics	9.236465			0.00026

From Table 2 the results show good fit. It explained that more than 85 percent of the variations in environmental degradation in Cameroon are accounted for by the variables specified in the models with less than 15 percent accounted by the stochastic error term. Their corresponding values of F-statistic are significant at 1 percent meaning that the results are more than 99 percent reliable as such should be used for policy recommendations.

The results in Table 2 shows that GDP, population growth, manufacturing value added and agricultural value added has a positive significant effect on environmental degradation in Cameroon. In terms of magnitude, this implies that a unit increase in GDP, population growth, manufacturing value added and agricultural activities in the country will increase the rate of environmental degradation by 0.012, 0.485, 0.324 and 0.059 units respectively. This result confirms that economic growth has the expected Kuznets effect on environmental circumstances in Cameroon. It implies that at the early stage of economic growth environmental degradation cannot be avoided. Also, the various agricultural practices which are taking place in the country like bush fallowing and shifting cultivation involves over-exploitation of soils, overgrazing, over cutting of wood, which leads to soil erosion, silting, flooding and also the excessive use of pesticides, fertilizers, causing land degradation and water pollution. This result is consistent with that of Ahmed *et al.* (2015). In addition, the manufacturing firms that are in the country couple with their crude techniques and outdated machines have only help to increase environmental degradation in the Cameroon. Since most of the industries in the country are related to natural resource allocation such as mining, timber, electric power, agricultural processing, constructions, cement, and brewery factories. Hence our result is similar with that of Phimphanthavong (2013). The influence of population growth indicates that population growth contributes to environmental degradation in Cameroon through the use of natural resources and

the production of waste and it is associated with environmental stress like loss of biodiversity, air and water pollution and increase pressure on arable land. This supports the Malthusian theory of population growth.

The value added in the service sector indicate a negative significant effect on environmental degradation throughout the period of study. This is in line with the a prior expectation. This study indicates that trade openness also produces a positive impact on environmental quality. The increase in trade openness leads to increased economic activity through investment and productivity, which degrades the environment. Based on the residual diagnostics for the results in Table 2, the study employs the Correlogram Q-statistics for autocorrelation which indicates that there is no autocorrelation.

Before presenting the result of environmental degradation on population growth the endogeneity test was conducted and based on the J –statistics the null hypothesis of no endogeneity problem was not rejected.

Table-3. GMM result of ED on POP.

Dependent Variable: POP				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ED	-42.49768	14.02209	-3.249120	0.0016
D(CBR)	21.62185	11.04757	2.007284	0.0728
D(LIT)	0.637853	0.643650	0.990993	0.3299
IMR	-0.551804	0.172742	-3.194381	0.0034
LEXP	0.951720	0.357527	2.833025	0.0115
C	52.38139	136.1348	0.384776	0.7032
R-squared	0.868616	Durbin-Watson stat		1.480865
Adjusted R-squared	0.846718			
F- Statistics	39.66759			0.000000

The coefficient of multiple determination indicates that 84 percent variation of population growth in Cameroon is accounted for by the joint variation of the variables included in the model, while the remaining 16 percent is explain by the error term. The significant of the overall model is justified by F-statistics which further confirms that the model best fits the regression line. The results in Table 3 indicates that environmental degradation exerts a negative significant effect on population growth in Cameroon. Going by its magnitude, a unit increase in environmental degradation will reduce the population growth in Cameroon by 42.49 units. This implies that the more the environment is degraded in terms of pollution, loss of biodiversity and arable land, the citizens in the country will be infected with diseases and hunger which will reduce the population of the country. This findings is not in line with the study by Aggarwal *et al.* (2001). Crude birth rate shows a positive effect on population growth. Specifically, a unit increase in the level of crude birth rate will increase population growth in Cameroon by 21.62 units. This is explained by the fact that the live birth is accompanied by low death rate in the country due to improvement in sanitation and health conditions of the citizens. The result is not consistent with those of Cutright and Kelly (1978). The coefficient of Infant Mortality Rate (IMR) is negative which denotes that as infant mortality increases population growth reduces in Cameroon which is in line with our a prior. This effect is significant as observed from the probability value of IMR in Table 3. This supports the fact that many infants died in Cameroon before reaching the age of 1 due to poor sanitation and health facilities which intend reduces the population. As mortality rates go down and life expectancy increases, fertility rates also go down. This mortality decline counteracts the negative impacts of a fertility decline on population growth rate because more people stay alive, thus contributing to a higher population size. The variable life expectancy shows a positive influence on population growth in Cameroon over the period of study. That is a unit increase in the life expectancy rate will increase

population by 0.951 units. It is also worth noting that since the advent of modern preventive medicine and hygiene, the population of the country has been increasing due to a longer life expectancy.

5. CONCLUSION AND RECOMMENDATIONS

An attempt has been made to provide ~~an~~ empirical evidence on the link between population growth and environmental degradation in Cameroon and how the structural change affect environmental degradation in Cameroon. Population growth, manufactured value added, and agricultural valued added exerts a significant positive influence on environmental degradation in Cameroon except the service value added over our period of the study. The findings also reveal~~s~~ that environmental degradation and infant mortality rate negatively affects environmental degradation in Cameroon. The following policy implications emanated from the results:

- Significant policy measures need to be taken to incorporate environmental concerns into agricultural development, urban planning, technological innovations, industrial growth, and resource management, the degradation of the environment is likely to worsen in the future. For such policy to be effective, special efforts should be made for informing and educating the people and local leaders about the adverse effects of large population through specially designed Information, Education and Communication (IEC) activities.
- Slowing down population growth of the country will be a key component of any effort to protect Cameroon's natural resources and environment. Population growth continues for many years after fertility reaches replacement level, so the sooner fertility can be brought down the sooner the process towards stabilising population numbers can begin.
- Although many international regional networks have been established and are in operations, these networks needs to be review and reorganised so that they can effectively and efficiently achieve their objectives. Dissemination of appropriate information and capacity building should have the highest priority of such networks and community based organisation should be established at local community level to bridge gaps between scientific information and individual end-users mostly farmers.

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