THE POPULATION GROWTH - ECONOMIC GROWTH NEXUS: NEW EVIDENCE FROM GHANA

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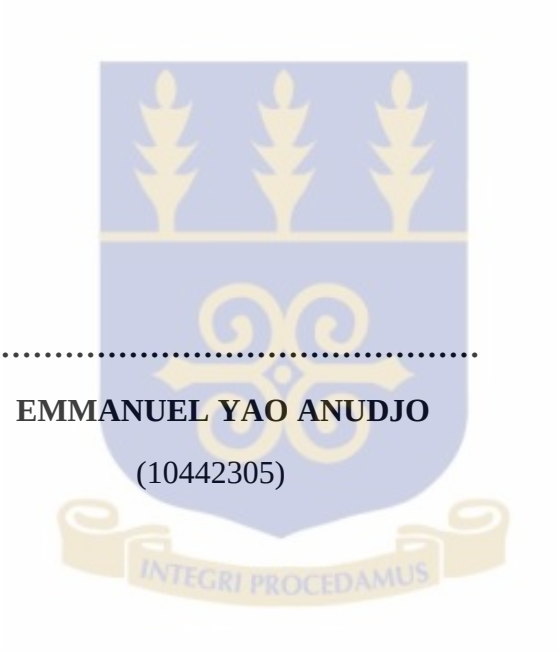
DECLARATIONS

I, EMMANUEL YAO ANUDJO, do hereby declare that this thesis is a result of research that has been undertaken by me under the guidance of my supervisors and that no part of it has been published for another degree elsewhere. Apart from references to other works which have been duly cited, this thesis is my original work.



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ABSTRACT

Establishing the relationship between population growth and economic growth has become fundamental to the policy makers in developing countries and Ghana in particular. However, there has been no agreement whether population growth is beneficial or detrimental to economic growth. This study therefore examines the empirical relationship between population growth and economic growth in Ghana using time series data from 1980-2013. It specifically explores the short-run and long-run relationship between population growth and economic growth as well as the direction of causality between them. The study employed the Autoregressive Distributed Lag Bounds (ARDL) approach of estimation strategy due to its small sample property and its applicability of whether a series is integrated of I(O) or I(1). Granger –causality test was also employed to determine the direction of causality between population growth and economic growth.

The study reveals a negative relationship between population growth and economic growth in the short-run and unidirectional causality in the long-run between them. The study further revealed that population density and labour force impacts positively, whereas unemployment rate impacts negatively on economic growth in the long run but gross capital formation was not statistically significant. Unemployment rate was statistically insignificant in the short-run. Gross capital formation, labour force and population density had a positive statistically significant effect on economic growth in the short-run but unemployment rate was not statistically significant. The ecm (-1) results reveals a high speed of 83.6 percent of long-run equilibrium adjustment every year after a long-run shock in the model. The study recommends that Government should continue encouraging its campaign on family planning and policies that would give rise to creation of job opportunities for the massive labour force that it has. The

government should also put measures to ensure that the economy grows at a higher rate than the population growth. This will ensure that the increasing demand of services arising from the population growth is met.

DEDICATION

I dedicate this study to the Almighty God for his abundant grace, guidance and protection; to my Wonderful mother, Mary Dussi Anudjo, my Daddy**,** Apostle Abraham Anudjo and my lovely Supportive wife, Sandra Anudjo and son, Emmanuel Eyram Dornu Anudjo for always being there for me.

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I am also grateful to the staff of the economics departmental Library for their help in getting some information related to the topic.

I also thank my parents, and siblings very much for giving me the needed support throughout my education.

Last but not the least, my appreciation goes to my friends: Derick Adu Taylor, Kingsly Damfer, Phidaux Ayitey, and Korsi Fiagbe for their unflinching support. I want you to know that you are the pillar towards the success of this thesis. My sincere thanks also goes to all who have one way or the other added value to my life to make this MPhil. Programme a success. I say Ayeekoooo.

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LIST OF ACRONYMS

ARDL	Autoregressive Distributed Lag
CO_2	Carbon Dioxide
GDP	Gross Domestic Product
HIPC	Highly Indebted Poor Country
HRD	Human Resource Development
ICT	Information Communication Technology
LDC	Less Developed Countries
MDC	More Developed Countries
OLS	Ordinary Least Squares
TFR	Total Fertility Rate
UNICEF	United Nations Children Emergency Fund
VEC	Vector Error Correction
WDI	World Development Indicators
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

There have been several debates over the past decade over the contribution of population changes on the economic performance of countries. However the debate on the link between population and economic growth has been raging since Malthus (1798, 1970), who expressed concern about the inability of the earth and its fixed resources to accommodate a rapidly rising population. Moreover, several researchers in their quest to identify the determinants of economic growth have heavily dwelt on non-demographic factors hence the true contribution to growth by demographic transition especially population growth have not been truly appreciated.

One of the distinguishing features of low and high income countries depends on how much income is spent on each child in a family relative to what is invested in the human capital development of the child. Increases in family size put financial constraint on the family, which could prevent children from getting access to quality education, good health care which retards human development for economic growth.

Population growth basically determined by mortality rate, birth rate and migration is a force of its own in the process of economic growth, sometimes seeming to promote growth, at other times impeding it. While countries are the principal level at which such relationships are identified, effects at the local level are often sharper. Population growth can directly affect the global economy through migration and disease transmission or indirectly through effects on geopolitics and major environmental systems.

"The population of Ghana is the nation's most valuable resource. It is both the instrument and the objectives of national development. The protection of its growth rate and enhancement of its welfare is the government's first responsibility and when that welfare is threatened government must act" (Ghana population policy, 1969).However , Ghana like most sub- Saharan African country has been experiencing a rapid rise in its population since the early 1950's. From a population of a little over ten million in 1980, Ghana's population now stands at about 25,904,598 as at 2013(WDI, 2013), indicating a steep increase in the size. The current growth rate of the population stands at 2.7 %. (WDI, 2013). Coupled with the above, sixty-three percent of Ghana's population is rural. Ghana is a lower-middle income country with a GDP per capita of 1645.5 US dollars as at 2013.

There is a growing concern in Ghana that while population growth may not prevent economic growth, economic improvements may occur more rapidly without this obstacle. A slower rate of population growth will ensure that more people will have better access to healthcare, education, social amenities and thus take advantage over the few job opportunities available to better their living conditions, (Gage and Njogu, 1994). Ghana has an annual population growth rate of between (2.1 to 3.5 %) and a GDP growth rate of between 5.2 to 7.9 % (WDI, 2013).

It must be emphasized that concerns about population issues in Ghana has to do with the high annual average growth rates of about 2.7 % and not about the number of people. With Ghana's population growing averagely at 2.7 % per annum, it is expected that the current population of 25,904,598 will double in 26 years, whilst for an advanced country like UK with a near stationary population size of about 69.1 million and growth rate of about 0.57 % (World Fact Book,2013), her population will double in 230 years. Germany has an almost 0 % growth rate.

In Ghana the warning that rapid population growth could be obstacle to economic growth and development was not taken seriously by previous governments until the 1969 population census revealed that 12.3 % of the population was estimated to be foreigners. This situation persisted until 1969 when the issue of population was recognized as a critical factor in development by the intellectuals as well as political leaders of the country. Ghana then became the third country in the Sub-Saharan Africa to come out with a comprehensive population policy in 1969 after the Republic of Mauritius and Kenya in 1958 and 1967 respectively which was meant to affect the growth, structure and distribution of the country's growing population. In comparative terms, Ghana has a land area of 87,853 sq. miles almost equal to that of UK of about 93,283 sq. miles. Later in a meeting held by Strategic Partnership for African development, the need was emphasized to speed up Ghana's growth to keep pace with its population growth rate so as to achieve the Millennium Development Goals. In order to achieve the above goal, it was agreed that Ghana's average per capita needs to at least double from 400 dollars to 1000 dollars with growth rates of between 9 percent to 10 percent in order to attain full middle income status before 2012. Currently Ghana's average per capita income is about 800 dollars with a growth rate of about 7.9 % (WDI, 2013).

1.1 Statement of the Research Problem

Population and Economic growth generally refers to the study of the consequences of population trends on socioeconomic growth and development, human welfare, and the natural environment (Hirschman, 2004).

The size of a population determines many factors such as its potential supply of cheap skilled and unskilled labor, its market demand, its ability to consume and cause an increase in aggregate

demand and the growth of GDP, its geopolitical importance, its tax revenue potential among others. It also has the potential to generate competition, efficiency and innovation. However, irrespective of the potential gains that is associated with high population, there is the need to ensure that the rate of growth matches the pace of economic growth otherwise it may create the problem of high youth unemployment rates, balance of payment problems as a result of increased net imports, corruption , inflation, food insecurity, deforestation, pollution, social vices and other environmental problems such as global warming and dwindling of natural resources.

Meanwhile, Dyson (2013) claims that mortality decline aids economic growth and hence leads to an increase in the standard of living. This means that decline in population may have negative effect on growth. In as much as population growth also provides a pool of labor force to be used in the production process with the potential to promote economic growth; it however poses some challenges which may equally impede the effort of countries in achieving desired economic growth and development.

Available data on population trends in Ghana indicates that the population of Ghana has been increasing since the 1920's. With a population of 2.2 million in 1921, the country's population tripled within 39 years to 6.7 million in 1960. The country's population kept on increasing at a very fast rate and almost doubled between 1960 and 1984 to 12.3 million. It again rises and more than doubled within 27 years to 24.8 million in 2011. Currently Ghana's population is estimated to be 25.9 million. (WDI, 2013).Ghana's annual population growth rate is therefore among the highest in the world. It has floated around 3.5% to 2.6% since 1983 to 2003 and 2.09 % in 2013 compared with the average rate of round about 1% for the Developed world, Afzal (2009).

The youthful nature of Ghana's population implies more schools and hospitals must be built, drugs must be found to support the ever growing children population who virtually are not producing anything to add up to GDP but are consuming whatever is being produced. Another important consequence of Ghana's Youthful and fast growing population is the building up of "population momentum". That is even if fertility were to drop drastically to 2 children per woman; the population would continue to grow for at least 40 years. The rapidly growing population of Ghana compounds the difficulty of realizing the goal of improving the quality of life of the people. Moreover Rapid population growth in Ghana is equally associated with high unemployment rates with figures ranging between from 17% per annum for the entire population to 60% for the youths because job opportunities are fewer than the number of people seeking for them, and stagnating economic performance because a large proportion of available resources is consumed instead of being invested to generate growth .

Ghana's population is also unevenly distributed. It is estimated as per the 1960, 1970 and 1984 Ghana population census reports that almost 97% of the localities in Ghana have populations of less than 1000 each. There is therefore high population concentration in few urban cities while vast areas particularly in the middle belt have sparse population densities. This has implications for the country's economic growth and development because those settlements lack the basic threshold population to justify the provision of certain social amenities and so are numerous settlements which have been denied basic infrastructure. Currently the Rural population growth of Ghana is estimated to be (0.7%) as compared to the urban annual growth rate of 3.37% (WDI 2013).

The fast growing population further put a lot of pressure on the environment arising from increased demands for goods and services as well as energy demands. According to Hansen (2008) it was estimated by World Bank in 1989 that the annual loss of forest in Ghana was about 72000 hectares and this has been the result of human induced activities such as the use of fire for land clearing, clearing of land for agriculture purposes, the cutting of trees and shrubs for fuel wood and so on. This has resulted in the rapid depletion of our natural resources. For instance Osei-Tutu (2010) estimates that about 21,699 hectares of forest in the western region alone are deforested a year (through farming activities and indiscriminate logging). The impact of population growth on C02 and deforestation is motivated not only by land use changing but also by poverty which compels most households in Ghana to depend on firewood and charcoal (fossil fuels) as their source of alternative forms of energy. The cause of carbon dioxide and deforestation problem is intricately likened to both current and future energy demand which arose due to population explosion .However the application of modern farming techniques and fertilizer could mitigate this problem, but unfortunately as a capital deficient country, the traditional methods of farming dominate agricultural practices in Ghana.

Overall, Ghana's population and its characteristics (high dependency rate between 41 to 45%) pose serious challenges for her growth and development, and not until Ghana achieve considerable decline in fertility rate and success in economic development, the nation's development efforts will be frustrated with high population growth rate which is an open challenge for management and policy makers.

Establishing relationship between population growth and economic growth has therefore been fundamental to the policy makers in different countries. However, there has been no agreement on whether population growth is beneficial or detrimental to the economic growth in the

developing countries. (Given this scenario, there was thus a need to establish the relationship between population growth and economic growth in Ghana). This study therefore attempts to examine the effect of population growth on economic growth in Ghana. Past studies such as Afzal (2009) and Boadu (2000) revealed that population growth negatively affects economic growth. Nonetheless, other studies (such as Kuznets, 1967; Kelley ,1988; Kelley and McGreevy ,1994; Thuku et al., 2013) also revealed that population growth have positive effect on economic growth in long run due to increase in productivity as a result of learning-by-doing by means of increase in production volume, and sharing of new ideas.

1.2 Research Questions

Arising from the statement of the research problem, the study attempts to answer the following research questions.

- What is the causal relationship between population growth and economic growth?
- Is there a sustainable long run relationship between population growth and economic growth?

1.3 Objectives of the Study

The broad objective of this research is to establish the effect of population growth (both quality and quantity) on economic growth of Ghana. The specific objectives are to;

- Investigate the causal relationship between population growth and economic growth in Ghana.
- Determine whether long run relationship exist between population growth and economic growth in Ghana.
- Make recommendations to policy makers based on the findings of this study.

1.4 Hypothesis of the Study

In line with the stated objectives, the following hypothesis will be tested:

H_o: Population growth has no significant effect on the economic growth of Ghana.

H_1: Population growth has significant effect on the economic growth of Ghana.

1.5 Rational for the Study

This study seeks to contribute to the ongoing discussion concerning the relationship between population growth and economic growth by limiting the scope to a country-specific study thus the case of Ghana. This study examines the economic effects of the demographic transition (both quality and quantity) in Ghana. It aims at establishing whether there is any link between demographic variables and economic growth in Ghana. The outcome of the study will be used to predict whether or not the rate of growth of Ghana's economy really keep pace with the rate at which its population grows over time.

As a matter of fact this study will provide empirical evidence and thus contribute to the existing knowledge of population growth effects on Ghana's economic growth. The study will also contribute to the knowledge of population and economic growth relationships in general. This

will fill the gap in the literature. Researchers and policy makers will be equipped by the work and come to grips with the problems associated with population growth and economic growth. This would provide them with vital information to better understand the relationship between population and economic growth which would inform their policy instruments on population in order to achieve the desired objectives.

The effect of population growth on economic growth has not received much attention especially at the national level especially in Ghana. However an attempt was made by Boadu (2000) to investigate such relationship. His finding shows a negative effect of rapid population growth on the economic growth of Ghana and therefore suggests a reduction in the size of the population. In view of this, there is the need to undertake a study to investigate further the link between population and economic growth different.

Most studies such as Mason (1997), Bloom and Canning (2001) and Dao (2012) on the subject matter have focused on cross-country analysis. These studies proffer general conclusions that may not necessarily apply to specific nations due to differences in countries' features such as data quality, culture, history, institutional differences and so on. The main contribution of this study is exploring the topic by bringing into fore the country-specific dimension especially the case of Ghana using data that reflects its peculiar demographic characteristic.

Several studies in their quest to identify the determinants of economic growth have heavily dwelt on non- demographic factors. For instance Solow (1957), hence the true contribution to growth

by demographic factors especially population growth have not been truly appreciated. However this study will purely be based on demographic factors and their effect on economic growth.

1.6 Organization of the Study

The study will be organized under six (6) chapters. Chapter one covers the introductory aspect of the study which highlights the statement of the research problem, objective of the study and rationale for the study. Chapter two will cover the overview of population growth and economic growth in Ghana. Chapter three reviews the literature on the subject area. Both theoretical and empirical studies will be reviewed. Chapter four covers the methodology of the study whilst estimation and empirical analysis of the results of the model estimated are dealt with in chapter five. Chapter six covers summary, conclusion and recommendations for policy makers.

CHAPTER TWO

OVERVIEW OF POPULATION AND ECONOMIC GROWTH ISSUES IN GHANA

2.0 Introduction

This chapter is devoted to the review of population growth trends and economic growth (GDP) in Ghana. This chapter will first tackle the issue of population growth in Ghana to be followed by economic growth (GDP) trends and with a summary of the issues dealt with in this chapter.

2.1 Population Trends in Ghana

Available data on population trends in Ghana indicates that the population of Ghana has been increasing since the 1920's. With a population of 2.2 million in 1921, the country's population tripled within 39 years to 6.7 million in 1960. The country's population kept on increasing at a very fast rate and almost doubled between 1960 and 1984 to 12.3 million. It again rises and more than doubled within 27 years to 24.8 million in 2011. Currently Ghana's population is estimated to be 25.9 million. (WDI,2013).

According to Boadu, (2002), the warning that, the uncontrolled rise in the country's population could hinder its development was not treated with the seriousness and urgency it deserved. There was a large influx of people of foreign nationalities especially from fellow African countries. This was confirmed by the 1960 population census in which 12.3% of the population was estimated to be foreigners. This situation persisted until 1969 when the issue of population was seen as a critical factor in the development agenda of the nation by intellectuals and politicians alike. Ghana then became the third country in the sub-Saharan Africa to come out with a comprehensive population policy in 1969 after 1958 and 1967 in Mauritius and Kenya

respectively. The policy was geared towards the growth, structure and distribution of the country's population. (Boadu, 2002).

Due to the lack of adequate and reliable demographic data, fertility and mortality are the principle factors responsible for Ghana's population change. The difference between fertility and mortality gives the approximate rate of growth of the population. However Table 2.1 shows the Crude Birth Rates (per 1000 births) and Crude Death Rates (per 1000 deaths).

Table 2.1: Crude Birth and Death Rates for Selected Years in Ghana (1955-2013)

Years	**1955**	**1990**	**1998**	**2000**	**2013**
Birth Rates (per 1000)	47	45	40	34	32
Death Rates (per 1000)	22	14	12	11	08

Source: Ghana Statistical Service and World Population Data Sheets,(2013)

From Table 2.1, it can be deduced that while Crude Death Rate have been declining at a faster rate, Crude Birth Rate have remained nearly constant over the years. This has resulted in an increasing Crude Rate of natural increase. (That is difference between the Crude Birth Rate and the Crude Death Rate) over the years as indicated in Table 2.2.

Table 2.2: Annual Average Growth Rates of population (in percentages)

Years	**1948-1960**	**1960-1970**	**1970-1980**	**1980-1990**	**1990-2000**	**2000-2013**
Average Growth Rate (%)	2.5	2.7	2.9	3.3	2.8	2.6

Source: Ghana Statistical Service and World Population Data Sheet (2013)

From Table 2.2, one can infer that the average rate of increase in the country's population has been declining since 1990's.For instance it fell from 3.3% between 1980 and 1990 to 2.6% between 2000 and 2013. In spite of the declining rate of growth in our population, it must be emphasized that given the rate of the country's development the current rate of growth of its population is still high.

Allied to the high rate of growth of the country's population is the issue of the youthful nature of the population and its inevitable dependency burden. The age- structure of Ghana's population is characterized by a broad base and a narrow peak towards the older age. As high as 45% of the population is under the age of 15 years in the 1990's .With this large percentage of the population under the age of 15 years, the working age population (15- 64 years) becomes almost equal to the dependent population (those below 15 and 65 years respectively). Currently 38.5 % of the population is below 15 years while 58.1% of the population falls between the (15-64) years bracket, with 3.4 % of the population in the 65 years and above category (WDI, 2013). The implication is that, the proportion of the population that needs to be supported by the working population becomes very large.

This is against the backdrop of the fact that large proportion of those within the working age is either gainfully employed, underemployed or earns inadequate income to support their dependents. This thus pushes a lot of dependents especially the young population to engage in all sorts of mania jobs to supplement the family meager income. It creates social pressure on the government to spend more on the welfare of the people through provision of portable source of drinking water, infrastructure among others so as to maintain a desired standard of living for the people.

Ghana's Total Fertility Rate (TFR) , That is the average number of children a woman will have during her reproductive life is quite high compared to some developed nations .For instance it is estimated to be 4.6 in 2000 and declined to 4.2 in 2004 (world bank, 2012). Compared to the Total Fertility Rate of more developed country like the United States of America (USA) over the same period is quite high. For instance the TFR for the USA in 2000 and 2005 was 2 (UNICEF, 2006). Below is a graph that shows the Trends in the fertility rates between Ghana and USA.

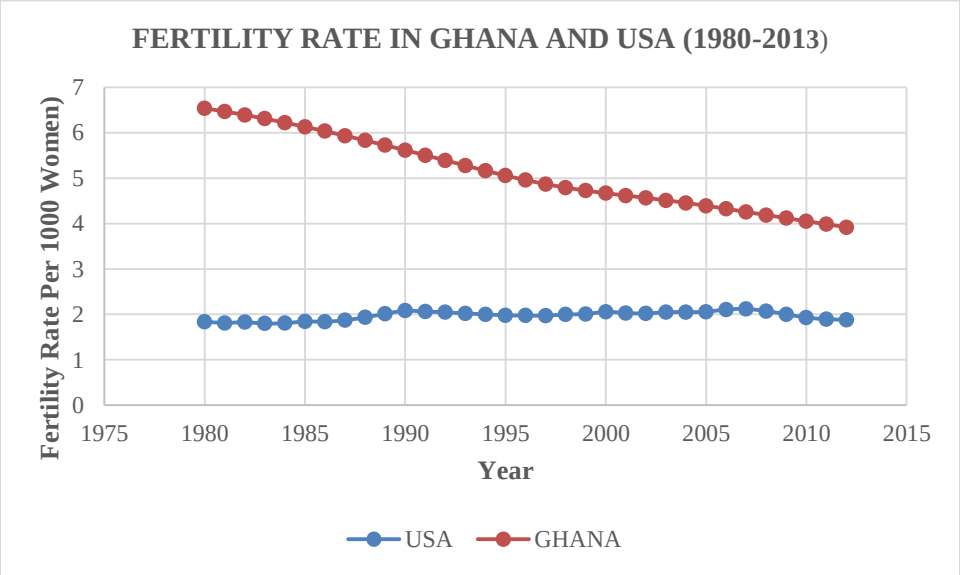

Figure 2.1: Fertility Rate Per 1000 Women in Ghana and USA from 1980-2013

It is an undisputable fact that rapid population growth affects the economy in several ways. With a current fertility rate of 4, the size of the labor force is projected to reach about 21.8 million by 2020 (Horton,1994).The number of people in the labor force in in 1970 was estimated to be 3.3 million and this increased to about 10.87million in 2006 (Horton,1994). The rapid growth of the labor force frustrates efforts to reduce unemployment through job creation programs since the extra population will put a strain on the economy and social services. If the number of jobs

created does not keep pace with the expanding labor force, unemployment will remain high or worsen over time. If Fertility Rate reduce or even remain stable over time it would go a long way in reducing the socio-economic burden of unemployment.

Similarly, a rapidly growing population implies a large school going population to educate. The estimated primary, Secondary, and Tertiary school enrollment rates were 77.2%, 38.7% and1.6% in1982 respectively. These rates increased sharply to 101%, 53.4% and 6.4% in 2007 and further increased steadily to 108.8%, 61.1% and 13.6% in 2013(WDI, 2013). Table 2.3 indicates the trend in enrolment rate for Primary, secondary and Tertiary education (% gross) in Ghana between 1982 and 2013.

Table 2.3: School Enrolment (% Gross) in Ghana for Some Selected Years (1982-2013)

Year	1982	2007	2009	2011	2013
Primary	77.7	101	105.5	106.7	108.8
Secondary	38.7	53.4	58.3	57.1	61.1
Tertiary	1.6	6.4	8.8	12.1	13.6

Source: WDI (2014)

The growing number of primary, secondary and Tertiary school enrolment rates also implies the need for more teachers to serve the increasing population. The estimated teacher-pupil ratio was one teacher to twenty-nine pupils. Reducing population growth will therefore implies that fewer teachers need to be trained; fewer schools need to be built and less money would have to be spent on education to achieve the same quality. The perceived savings in education from lower population growth could then be allocated to other development activities in other sectors of the economy or be used to provide quality education.

Another area that is affected by rapid population growth is the health sector. The concern here is not merely the health of the people per se but also the effect of population growth on the quality of the healthcare system. With the rise in population, there would be the need for more doctors to be trained and more health facilities need to be provided to keep pace with the population growth. This situation becomes more serious given the economic condition in the country and the fact that most of the Ghanaian trained Doctors' have the tendency to leave the country to seek for greener pastures elsewhere as a result of poor condition of service. For instance the World Health Organization (WHO) report of 1997 puts the physician population ratio at 121 doctors to 100,000 population and 232 Nurses and Midwives per 1000,000 people. The Table 2.4 shows the Nurses, Midwives and Physician ratio per 1000 people in Ghana for a selected number of years.

Table 2.4: Nurses, Midwives and Physicians (per 1000 people) for selected years in Ghana

Year	Nurses and Midwives	Physicians
2004	0.92	0.15
2008	0.975	0.11
2009	1.046	0.085
2010	0.926	0.096

Source: World Development Indicator (2013)

From the table 2.4, it can be inferred that the Nurses and Midwives' ratio (per 1000 people) increases infinitesimally over the period but falls in 2010. On the other hand that of the Physician ratio (per 1000 people) falls over the period and rise in 2010. It can be noted that the rate at which the Ghanaian population grows, far exceed the pace at which its health attendants rate grows over the period.

Rapid population results in more mouths to feed. The increase in demand for food due to population growth can be met either through an increase in domestic agricultural production or through greater imports of food products. As the population grows, total demand and consumption of agricultural products increase. Although the climatic conditions and soils in the country may favor a host of crops to be grown to feed the growing population but the current level of technology and the traditional methods of farming coupled with the high prices of agricultural inputs could force the country to import most of its foodstuffs in the face of rapid population growth. Currently, Ghana depends heavily on rice imports. Being a predominantly agricultural based economy, it would be disastrous if population growth were to hamper efforts to achieve self-sufficiency in food production. In relation to more advanced countries, Ghana is less urbanized. Table 2.1 sheds more light on the distribution of rural and urban population in Ghana.

Table 2.5: Rural and Urban Population Distribution; 1960- 2013 (%)

Year	**1960**	**1970**	**1984**	**2000**	**2013**
Rural Population	77	71	68	56.2	44.4
Urban Population	23	29	32	43.8	55.6

Source: GSS (19760, 1970, 1984, 2000)

According to the 1984 population census report, 32% of the country's population lives in urban areas (I.e. settlements with 5000 or more people). It can be inferred from the Table 2.5 that the population of people living in the rural areas of the country has been declining over the years

whilst that of the urban areas has been rising steadily. The Urbanization situation in Ghana is quite worrisome considering the fact that majority of the urban population is concentrated in few urban centers such as Accra, Kumasi,Tema, Sekondi-Takoradi and others where growth has been very rapid for various reasons such as industrial developments, administrative and social functions.

The 1984 population census estimated the rate of urbanization at 3.3% per annum. It is worthy to note that these towns and cities solely rely, for part of their food, energy and other supplies on the surrounding lands. The critical factor is the area around the settlements within which the direct supply is obtained. The spatial growth of Accra brings into sharper focus the dangers rapid urbanization poses to Ghana's socio-economic development. In 1945, Accra occupied less than 10% of its present size. Similar developments are occurring in other urban centers. As the agricultural lands surrounding the urban areas are taken over for housing and other economic activities, the country's capacity for food production is diminished.

The gravity of the impact of rapid population growth on the economic growth can be better appreciated if one recognizes that achieving sustainable development requires, economic and social development in addition to an effective preservation our productive natural resources. Unfortunately due to the increasing pressure on the land and the resulting deforestation, Ghana's closed forests and derived savannah zones have been dwindling in size at a faster rate. This phenomenon has also had an adverse effect on the quality of air in the country and there is the need for a concerted effort to arrest this tide.

2.2 Trend of Ghana's Economic Growth

Economic growth is the steady process of increasing productive capacity of the economy and hence increasing national output (GDP) and income respectively. Growth occurs when an

economy expands its output of goods and services over time. Growth can either be extensive or intensive. Extensive growth occurs as a result of the expansion of the economy's resources while Intensive economic growth occurs as a result of the more efficient use of available resources to achieve desired growth.

The concern with economic growth arises out of the fact that the greater the rate of growth of the economy the greater 'other things being equal', the increase in the level of well-being of its citizens. There are five stages of economic growth which all economies are considered going through in their development from fairly poor agricultural societies to highly industrialized mass consumption economies. These stages according to Rostow (1990), the stages of economic growth are the traditional societies, the pre-condition for takeoff, the take off stage, the drive to maturity and the age of mass consumption.

In general 'Ghana has not experienced self-sustained economic growth during any period after independence and before the Economic Recovery Program (ERP) was launched in 1983. On the average, growth in per capita GDP was -1.5% between 1960 and 1983. Growth was slightly positive during the 1960's (0.6% per capita) but fell to -1.8% per capita for the 1970s.While there are brief periods of rapid economic growth, they were due to either business cycle perturbations (booms) or recoveries from drought. In the early 1960s, for example, growth was moderate but it was driven by unsustainable public expenditures which ended in a balance of payments and debt crises in 1965 and a subsequent recession. Growth briefly picked up again with the Busian government in 1969, again spurred by greater public spending and high international cocoa prices, but this also proved short-lived, ending with the 1972 balance of

payments crises and the Acheampong coup. From that year until the Economic Recovery Program (ERP), the economy shrank in many years.

After 1984 the economy grew steadily in per capita terms, albeit at a moderate pace of 4-5% per year or 2% per capita. GDP averaged 3.93% between 1983 and 1989.The highest rate during the period was in 1984 at 8.8% while the lowest rate was recorded in 1983 at -4.5%. The Figure 2.2 shows the trend of Ghana's GDP growth Rate from 1980 to 2013.

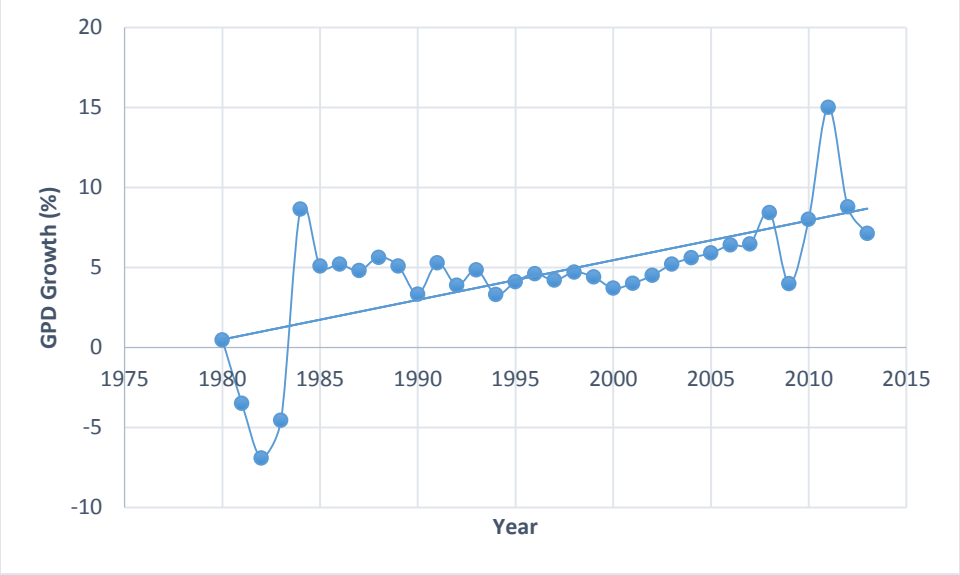

Fig. 2.2. Trends in Ghana's GDP growth from 1980 to 2013 (%)

From the graph it can be inferred that, the Ghanaian economy suffered its worst growth performance for about a decade in 2000 when real GDP growth slumped to 3.7%. The 2000 performance continued for successive years of economic decline. The poor performance in 2000 was attributed to terms of trade deterioration as the prices of the country's main export earners, namely gold and cocoa fell while the price of crude oil, the nation's main import commodity rose rapidly. This development led to a severe drop in foreign exchange earnings. Poor domestic economic performance that created fiscal imbalances and excessive monetary growth

compounded the external problems to lead to substantial reductions in production and consumption.

The performance of the economy has been quite remarkable since 2001. The GDP growth rate averaged 4.9% between 2001 and 2004. This could be attributed to the increase in capital flows into the country and fiscal austerity measures put in place by the government. The country joined the highly poor indebted countries (HIPC) initiative in 2001. This initiative led to increased capital inflows from the country's development partners. Much of the capital inflows were spent on infrastructural facilities to open up the country for an accelerated growth to keep pace with the rapidly rising population. The expenditure pattern has also received serious monitoring from the development partners which help the government to achieve most of her fiscal and monetary objectives over the period. For instance projected GDP growth rate for 2003 was realized.

In 2004, there was persistent increase in crude oil prices on the world market which necessitated the transfer of resources earmarked for social and development programs to the procurement of crude oil as well as huge transfer of resources to the Tema Oil Refinery to subsidize the prices of petroleum products. In spite of these challenges, the economy was prudently managed and the performance was quite remarkable. The growth rate was 5.8%, exceeding the projected growth rate of 5.2%.

Although, the government managed the economy so well, the performance of the country can be attributed to the increased capital inflow from the sale of cocoa to the international market. The producer price of cocoa on the international market increased from three million four hundred

and seventy five thousand cedi's (3,475,000) per ton in May 2001 to nine million cedi (9000, 000) per ton in October 2004.An increase of more than 150% during the period.

Economic growth could be characterized by what is termed as a continuous increase in Gross Domestic Product (GDP) but its trickle-down effect has not achieved the real desired impact on the poor. Though Ghana has had 15 years of uninterrupted growth, which could have influenced positively on aspects of the poverty, much has not been achieved at all levels in the economy due to the persistent rise in the population annually.

Most of the Government of Ghana's policy targets have often been centered on certain macro-economic indicators such as Inflation, exchange rate, and many others for stabilization. However social, environmental, political, and cultural and most especially population issues among others have not been given the needed attention.

Also at the heart of the government of Ghana's economic development programs are essentially the reduction of poverty and the general improvement of the well-being of the populace. However the strategy for poverty reduction that was developed in 1995 emphasized economic growth, integrated rural development and the expansion of employment opportunities for the rural and urban poor and to improve access by the rural and the urban poor to basic public services such as education, healthcare, water and sanitation and family planning services. In this regard, poverty reduction is aimed at strengthening the capabilities of the poor and the vulnerable to earn income to enable such groups acquire necessities. It is worthy to note that the above could only be achieved if the rate of growth keeps pace with the rate at which the population grows. This is because the rapid growth of the population implies a sharp rise in the labor force compounding the already high unemployment rates.

2.3 Chapter Summary

Chapter two highlights on the overview of population and economic growth issues in Ghana where population and economic growth trends were dealt with. It can be seen that whilst there has been an increasing trend in Ghana's population growth rates since 1980 to 2013, there has been a fluctuating trend in its GDP growth over the same period. The increase in the population growth is as a result of increases in Crude Birth Rates (per 1000 births) as against a sharp decline in the Crude Death Rates (per 1000 deaths) as a result of the improvement in the health delivery system of the country. This has led to a sharp increase in the dependency ratio (young population below age 15 and aged population over 64 years) over the economically active population (between age 15 and 64 years inclusive).Coupled with the high population growth rates is the Total Fertility Rate which is very high as compared to some developed countries like the United states of America. For instance the Total Fertility Rate of Ghana was 4.6 and 4.2 respectively in 2000 and 2004 while that of the United States of America was fairly stable at 2.

In general, Ghana has not experienced a self- sustained economic growth during any period after independence and before the implementation of the Economic Recovery Program (ERP) in 1983.This is due to the fact that as the population grows, the labor force also grows more rapidly with it and since Ghana is a developing country with high unemployment rates the problem is compounded. For instance the size of the labor force was estimated at 3.3 million and 10.87 million respectively for 1970 and 2006 and thus projected to reach 21.8 million by 2020 (PIP, 1994 and World Fact Book, 2006).The rapid growth of the labor force frustrates governments efforts to reduce unemployment through job creation programs since the extra population will put a strain on the economy and social services. The unemployment rate will increase sharply or

worsens overtime since the number of jobs available does not keep pace with the expanding labor force. The remarkable performance of the Ghana's GDP growth of 4.9% between 2001 and 2004 was due to the increase in capital inflows as a result of fiscal austerity measures like the HIPC initiative employed by the government in 2001 and the increased export revenue obtained from the sale of Cocoa in May, 2001. The next chapter presents the theoretical and empirical literature review on the relationship between the demographic variables and economic growth.

CHAPTER THREE

LITERATURE REVIEW

3.0 Introduction

In this chapter, a critical review of the relevant theoretical and empirical literature is undertaken. The chapter is divided into three sections. Section one reviews various theories on both economic growth and some theories of population growth while section two reviews some empirical studies that existed on the subject. Section three gives the conclusion drawn from the literature review. The essence of the review is to ascertain both the theoretical and empirical underpinnings available and relevant to the subject under study so as to identify the important variables to be included in the empirical model. This will thus help to fill the gap in the literature. Once the variables have been identified, a growth model incorporating various variables will be formulated in order to establish an analytical link between these variables and growth.

3.1 Theoretical Review

3.1.1 Theories of Economic Growth

Theories about Economic growth can be traced way back in 1776, when Adam smith first published his famous treaties, "The Wealth of Nations". Ever since, economic growth has been greatly researched into by many scholars and the research is still on going.

Adam Smith (1776) was hopeful in his assessment of human progress. His writing echoed the belief that economic growth could continue indefinitely if there were no obstacles to specialization and the division of labour such as mercantilism, which he felt impeded the development of competitive markets and limited the process of division of labour.

Harrods (1939, 1948) also shared his view on the literature on growth in relation to both developed and underdeveloped economies but explained in fairly different ways which is relevant to modern developments in growth theory. Harrods's original contribution cast the Keynesian short-run equilibrium condition in a long-run setting and asked, among other questions, what, if any, mechanisms existed to allow us to suppose that a full employment balanced growth path was either possible or likely. According to Harrods's specification, the warranted rate of growth of an economy on the basis of full employment depends on expectations about its firm's investment decisions and the natural rate of growth of its population among others such as technological improvements, accumulation of capital and so on. He defined the warranted rate of growth (g) as that growth rate in which the expectations upon which firms base their investment decisions are confirmed, or warranted by the spending and saving (s) decisions of consumers.

In order to discuss the issue of full employment in a growth model, Harrods thus defined a natural rate of growth (n) as "the maximum rate of growth allowed by population, accumulation of capital, technological improvement and work/leisure preference schedule, supposing that there is always full employment" (Harrod,1939). The central question posed by his model was to find out whether it is possible for **g = n**.

In Harrods's model there is no mechanism that links **" n'' and ''s''** and as a result the achievement of a balanced growth path entirely depends by chance and given the dynamics suggested for the warranted growth rate, it is unlikely to be maintained even if achieved. The first phase of the subsequent development of growth theory consisted of asking whether Harrods's conclusion was justified.

Solow (1956) criticized the Harrods's model to analyze long-run problems with the usual short-run classical analysis. In his study, Solow, took all the assumptions underlying the Harrods's model and asserted that an aggregate production function exhibits constant returns to scale in labor and reproducible capital. This can be written in general form as follows:

$Y=F(K,L)$ (1)

Where Y is output or income, K is the stock of capital and L is the labor force. The function expresses the output Y which depends on a given state of knowledge, with a given range of available techniques and a given array of different capital, intermediate goods and consumption goods.

With constant returns to scale, output per worker (Labor productivity) $y=Y/L$ will depend on the capital stock per worker (Capital intensity) $k=K/L$. Under the assumption of constant returns to scale, the relationship each unit of labor has with capital in production does not change with the quantity of capital or labor in the economy.

A crucial property of the aggregate production function is that there are diminishing returns on the accumulation of capital. In other words, each additional unit of capital used by a worker produces a decreasing amount of output. A form called the Cobb-Douglas function usually expresses the relationship:

$Y=L^{1-a}K^{a}$, $0< a< 1$ (2)

Alternatively the per worker production function can be written as:

$y=f(k)=k^{a}$ (3)

In other words, labour productivity can increase only if there is capital deepening (i.e. if capital intensity increases).

The critical tenet of the neoclassical model is that, under decreasing returns to capital, output per worker does not increase indefinitely. While the decline in the capital stock per worker due to depreciation and population growth is proportional to the capital stock, the growth of per worker capital through savings is constrained by decreasing returns on capital in production.

When the marginal product of capital per worker falls to a sufficiently low level, gross investment will be just sufficient to maintain the existing stock of capital. In the steady-state equilibrium, output and the capital stock will both continue to grow, but only at the rate of population growth.

The model's implication does not account for empirical evidence of long-term growth. Using this framework, Solow (1957) demonstrated that an attempt to account for decades of US economic growth produced an astonishing residual of approximately 85%. Solow attributed most of the residual to technological change.

An obvious limitation of the Solow model (1957) is its failure in accounting for the causes of technological progress. Although the model shows that technological progress contribute to economic growth, it does not spelt out why technological progress takes place. The rate of technological progress is set at, g, without any theoretical relationships with other variables in the model (that is the rate set exogenously). The justification normally given is that technological change originate from knowledge produced by the public science base (example Universities, public research institutes and so on) outside the domain of the economic system the model expresses (Solow, 1957; Shell, 1966 and 1967).

However, there is every reason to believe that technological progress itself depends on economic decisions, to much the same degree as capital accumulation. Entrepreneurs look for ways to make profit and one way of doing this is to produce new ideas. Since there is a profit incentive to produce new knowledge and to innovate, knowledge creation and innovation need to be incorporated into a model of economic growth in such a way that, while they spur economic growth, they are intend advanced by economic growth. In other words, technological progress needs to be endogenised.

Another issue of the Solow (1957) model is its assumption of cost and return to scale. There is some evidence that suggests increasing returns in long-term economic growth. This is empirically examined by Kendrick (1976) in his study when he attempted to explain US economic growth by adding intangible investments, such as human capital (example, R&D and education and training), to the capital stock that normally consists of tangible components (that is physical capital and labour). He found that, between 1929 and 1969, an annual growth rate in real total capital (2.4%) represented only 70% of the 3.4% average annual growth of real product in the private domestic economy (Kendrick, 1976). Romer (1986) suggests that given the repeated failure of this kind of growth accounting exercise, there is no basis in the data for excluding the possibility that aggregate production functions are best described as exhibiting increasing returns.

The failure of neoclassical models to introduce technological progress in such a way to account for its causes (that is endogenised technological progress) is, in large part, due to technical difficulty in dealing with increasing return in a dynamic general equilibrium framework. Attempts to understand increasing returns have sought their source in technological progress.

However, the approach entails technical difficulty if it is to maintain the Walrasian framework of marginal product.

More recent attempts to endogenised technological progress were stimulated by Romer's two seminal papers (1986 and 1990), by assuming that technology is a public good but the private investment in capital increases the level of technology available to all firms. The externality associated with investment overturns the assumption of diminishing marginal returns to investment in this model therefore; economic policies that alter the investment rate will affect economic growth.

With respect to the endogenous technical progress, Helpman and Grossman (1988) have built an elegant two-country model that emphasizes the role of research and development (R&D) in the growth process. In this setting, research and development are necessary to obtain this variety so firms have strong incentives to devote skilled labour to this activity. Since the outlays on R&D that generate these inputs are recouped by firms that operates in monopolistically competitive markets, governments policies that affect the incentives to invest in R&D will have long-run growth effects. Thus, these models show that the overall policy regime of a country can alter savings and investment allocation decisions in ways that alter long run growth.

Though the above models provide the framework for considering endogenous growth in a general equilibrium setting, the broad nature of their results make it difficult to isolate the effect of specific policies on growth. A number of models have therefore been developed to deal with specific policies and empirical issues. Since many indicators of macro-economic variables have been simultaneously found to be correlated with growth, the Solow type model has been extended to incorporate macroeconomic variables (Chenery, 1986). According to Rivelt (1991), in equilibrium framework there can be no justification for adding macroeconomic variables to

the basic neoclassical model. However, if disequilibrium effects are allowed then structural macroeconomic variables (such as inflation and exchange rate)which in addition to capital and labour determine growth rate, may be added to the basic model in developing countries, it may be vital for policy makers to understand the relative importance of those factors that affect long-term growth.

3.1.2 Theories of Population Growth

There is a marked difference in the models of population growth and economic growth proposed by Malthus (1798) and later Solow (1957), which allow for no per capita growth of income as capital is fixed. However, later models do allow for per capital economic growth and appear to fit the observable conditions in the recent past. The Malthusian model given above stipulates that whereas population is increasing at a geometric rate, food production was increasing with arithmetic rate. According to Malthus if measures were not put in place to check how rapidly population is growing then the population will check itself through what he termed as "positive check". According to him the earth and its entire resources are fixed in supply and since population growth outstrips food production, there will be famine, wars and other natural disasters as a check on the population growth. Malthus proposed that since population growth is detrimental to economic growth of a nation, stringent measures should be put in place to curb the rise among which includes moral suasion, education, delay in marrying, spacing of child births, and the use of contraceptives and so on.

The Malthusian model is considered accurate in pre-industrial societies but fails to work correctly in industrialized environments where division of labour and specialization are possible. To reconcile the difference between the two fundamental environments, some have created

multiphase models which allow for Malthusian, Post – Malthusian and finally Modern regimes, (Galor and Weil 1998) whilst others such as Simon- Steinmann (Simon, 1986) have created two models, one of each of the two stylized named the More and Less Developed Countries (MDC and LDC respectively) (Simon, 1977), effectively treating the two groups as distinctly separate.

The rationale behind this distinction is that a "demographic transition "in one (the MDC) and is now beginning to occur in the LDC nations but under different circumstance. Most of these circumstances are economic in nature and the tacit assumption is that economics is the driving force behind the transition and not the other way around as has been suggested by Knodel and Van De Walle (Greenhalgh, 1995).

In the case of Galor and Weil (1998) model, there appears to be an assumption that today's economic world is different from the one that Malthus observed. However Simon does not explicitly make this assumption but also does not deal with any historical perspective earlier than the industrial revolution other than anecdotal evidence of Greece and Rome in "The Ultimate Resource" in part due to lack of economic data.

Malthus (1798; 1830, 1970) in his research stated that prior to the transformational stage of societies into well organized and developed ones, rapid population growth results in a worsened standard of living because of low level of technological advancement in agriculture, and fixed supply of land. To him rapid population growth may inevitably collide with the scarce resources and if not checked would lead to famine, war, and other natural disasters like diseases.

Around the late 1960s, Neo-Malthusians analysts and commentators further expanded the view of Malthus and asserted that societal institutions cannot adjust economies to accommodate

pressures from rapid population growth and high human density which may in turn cause havoc to the environment and social fabric.

The opposite view, that institutions can faultlessly handle these changes if allowed to occur without restriction, was shared by two groups of scholars, Neoliberals and Distributionists. They oppose the Malthusian view where Simon (1972),a Neoliberal argued that population growth is not a problem and that discussion of it only distracts attention from real problems since institutions can evolve, supported by technological progress with inventions may provide all the necessary tool for adjustment. Distributionists also thinks, concern about population growth is destruction from real problems and that state institutions may implement poverty alleviation and equity programs which may serve as adjustment mechanism. Both schools affirmed that the positive economic effects that may result from their own brand of institutional mediation may cause a decline in demand for children.

In the midst of this debate, emerged the Revisionist view in the 1980s .They argued that to adequately adjust for population growth, populous countries must have a broad array of functional modern institutions whose smooth performance may help to curb any possible negative effect of population growth. They cautioned that poor performance of these institutions would precipitate dire economic consequences in such economy. This includes low levels of output per worker and failure to meet societal goals for allocating goods and services. They concluded that irrespective of the size of national output, population growth can degrade renewable natural resources when property rights are nonexistent or inadequately assigned.

By the late 1980s, most of the population policy discussions went in favour of the revisionist view that the effects of population growth on the economy were insignificant (Birdsall *et al.*

2001). This was revealed by the 1986 National Academy of Sciences report which stated that "On balance, we reach the qualitative conclusion that slower population growth would be beneficial to the economic development of most developing countries" (Landau and Rosenberg, 1986). This is a very weak and qualified observation that led to a decline in the political and policy priority on reducing population growth in order to boost economic growth in developing counties. Cairo Population and Development Conference (1994) emphasized the need of women's reproductive health and gender equality as the most important policy goals, not lowering world population growth.

According to revisionists high population growth rate in developing countries have insignificant effect on per capita GDP growth since mid- nineteenth century. This position has been largely espoused by Kuznets (1967), Kelley (1988), and Kelley and McGreevy (1994) where they argued that population growth may have had positive effect on economic growth in long run due to increase in productivity as a result of learning-by-doing by means of increase in production volume, and sharing of new ideas Kremer (1993).

In the 1990s, there has been a shift back to the orthodox position that population growth has a negative effect on economic growth. This is supported by the 2001 analysis of essays collected and empirical analyses in Population Matters (Birdsall et al. 2001). Kelley and Schmidt (2001) have empirical facts that changes in fertility and mortality from 1960 to 1995 have caused about 21 per cent of the increase of approximately 1.5 per cent per capita annual output for this period. There have been several studies which affirm the positive effects of population growth on economic growth. Such studies conclude that the East Asian economic miracle has being as a result of rapid growth of its labour force (relative to the dependent population), which was

caused by the rapid demographic transitions in these countries (Bloom and Williamson 1998; Lee et al. 2001).

Thirlwall (1993) in his book "Growth and development with special reference to developing economies" said the relationship between population and economic development is a complex one, particularly concerning what is cause and what is effect. According to his book, many people consider rapid population growth in the third world to be a major obstacle to development, yet there are many ways in which population growth may be a stimulus to progress and there are many rational reasons why families in developing countries choose to have many children. He said the complexity of the subject is compounded by the fact that economic development is a multidimensional concept.

The United Nations world population conference held in Bucharest in 1974 adopted a world population plan of Action that asserted "population and development are interrelated, population variables influence development and are also influenced by them". The plan recommended that "population measures and programs should be integrated into comprehensive social and economic plans and programs and this integration should be reflected in the goals, instrumentality and organizations for planning within the countries.

Dietzel and Clarke (2007) in their book " Population growth and land use" stated that population growth is the only force powerful enough to push primitive communities to change their life and in the long run transform them into such more advanced and productive societies. Moreover their book supported the argument of Khaldun in 1406 (Lawrence, 1984) in the 14th century that the product of two men working together would be more than twice that they would have produced working independently.

3.2 Empirical Review

It remains very important whether there is any causal link between population growth and economic growth, not only for demographers and economists but also for policymakers. Numerous researchers have examined the population growth-economic growth nexus for cross country, developed countries and developing economies using a wide variety of approaches which includes time series as well as cross sectional data. In this section, a selected number of empirical studies are reviewed and found mixed evidence.

Jones (1996) employed a Cobb-Douglas economy-wide production function to investigate the effect of population growth on steady- state income per capita as well as economic growth in the transition to steady state. Their empirical study revealed that an increase in population growth rate of 10 percent (3% to 3.3%) would lead to a 5 percent decrease in per capita income in the steady state. Their study also points out that since human capital is constantly employed as an additional productive factor in the production process, then the negative effect of population growth deepens as the population expands over time. This is so because economies would be forced to use their scarce savings to equip young people with the required physical and human capital. The study also found out that a 1 percent increase in population growth would reduce per capita income by 2 percent. The concluded that population growth negatively affect economic growth.

Bucci (2008) conducted a study to ascertain whether there is a sustainable long –run relationship between population (size and growth) and per capita income with special focus on human and physical capital as reproducible inputs. The study found out that population growth impacts negatively on economic growth. The study was further extended to examine the link between the interaction of physical and human capital which gives rise to a new human capital. As the two

inputs are made substitutes of each other in the education sector, the study revealed that population growth impacts negatively on per capita income in the long run.

The UN Development Program (2000) reported that "in many cases [in the developing world] lots of employment was being created, but not fast enough to match the rapid growth in the labor force''. This finding suggested a negative effect of population growth on economic growth but this adverse relationship did not emerged in multi-country comparisons in 1960's and 70's except for the poorest of developing countries (Cincotta and Engelman,1997).

Coole and Hoover (1972) in their study on "population growth and development in low income countries" stated that the pace of economic development depends on the diversion of resources from consumption to uses that raise future output. However a population with a high ratio of dependents on producers consumes more of a given output and devotes less to investment. Thus this high fertility, which produces a high level of dependency, promotes consumption at the expense of investment.

It has been argued however that as more data become available, studies have begun to detect deleterious impact of population growth on economic growth. Birdsall and Sinding (2001), Barro and Sala-i-Martin (2004), Sachs (2008), and Headey and Hodge (2009) studied the effect of population growth on economic growth and all concluded that rapid population growth exerts negative significant impact on economic growth in developing countries.

Reed and Gill (1997) investigated the relationships between population growth and economic development for the economy of India. He found that population growth is good but up to some extent, while large population caused pressure on the resources within the economy. He concluded that large population growth has negative impact on economic development. Schultz

(1985), employed a time series data (1860-1910) of Sweden. He found out that a 25% decline in fertility in Sweden was due to a 50% reduction in mortality.

Tilak (2007) investigated the relationship between population growth and economic development for the economy of India for the period between 1988 -1998. He concluded that India is one of the fasters growing economies, primarily due to the rise in its population growth creating a positive effect on its long run economic growth. India is now ranked one of the top producers in agriculture and is a top nation in terms of GDP in a developing country. In many cases, economists are correct in saying that population growth has a positive effect on economic growth of a nation. In reality, economists might say, "If it weren't for its high populations India would still be a suffering developing nation".

Lloyd and Gage-Brandon (1994) in their paper "High fertility and children's schooling in Ghana": sex differences in parental contribution and educational outcomes" said that in Ghana, girls with many young siblings are less likely to be enrolled in school than boys. Seeking future security in their old age, parents prefer to educate sons to daughters. Girls are also more likely than boys to drop out of school to care for younger siblings. The probability of dropouts for boys increases as the number of older siblings increases. He concluded that high fertility reduces educational attainment at higher levels and increases the workload and financial responsibilities among older siblings by means of increase in production volume and sharing of new ideas, Simon (1981, 1989).

Savas (2008) investigated the relationship between population and per capita economic growth in the Central Asian Economies (CAEs). The ARDL technique to cointegration was employed for the study. Their study revealed that there is long run positive relationship between population and economic growth.

Peng (2002) examined six Asian countries the relationship between population growth, productivity and division of labor. The studies found out that population cannot explain productivity but instead productivity is explained by the division of labor which is determined by transaction efficiency. He suggests that population growth can provide more scope for evolution in the division of labor that leads to productivity progress.

Arif and Chaudhry (2008) analyzed the impact of human capital on economic development for the economy of Pakistan for the period of 1990-2005. They found from their study that investment in human capital will lead to economic development in the urban area while dismal in the rural area particularly in female. Pakistan can benefit from investment in human capital and provide employment opportunity for the target to get economic development.

Afzal (2009) analyzed the impact of population growth on economic growth for Pakistan economy over the periods between 1951 to 2001.OLS estimation was incorporated and his findings suggested that population growth had negatively contributed to economic development and considered population growth is real problem.

Hussain *et al.*, (2009) investigated the relationship between demographic variables and economic growth for the economy of Pakistan for the period of 1972- 2006. The outcome of the study shows that the reduction in infant mortality rate and total fertility will help in accelerating the pace of economic growth in positive direction.

Zaman et al., (2001) investigates the relationship between population growth and per capita income for the economy of Pakistan, for the period 1960-2001, using Johansen's co-integration approach. The result shows that there is no long run relationship between population and per capita income.

Alam *et al*., (2003) analyzed the dynamics among fertility, family planning programs and female education for Pakistan over the period 1965-1998. The results are found to be consistent with theoretical statement that maintain that although in the long run the sufficient condition for fertility decline may be the result of complex dynamic

Stephenson et al., (2007) investigated the relationships between demographic and economic variables for Spanish economy for the period 1960-2000. Bivariate Granger Causality has been examined to look at short run relations. The results from multivariate causality analysis and the Generalized Impulse-Response Function show that total fertility responds directly to GDP and Infant Mortality does not cause total fertility.

Ashraf *et al., (*2012) employed simulation model to assess the quantitative effect of exogenous reduction in fertility on output per capita. The model employs parameters which include schooling, the size and age structure of the population, capital accumulation, parental time input into child-rearing, and crowding of fixed natural resources. The model was then applied to examine the effect of a change in fertility from the UN medium-Variant to the UN low-variant projection using Nigerian vital rates as a base line. The study found out that for a base case set of fixed natural resources such a change will raise output per capita by 5.6 percent at a horizon of 20 years and by 11.9 percent at a horizon of 50 years.

Bruckner et al.,(2014) examined the effects on population growth of shocks to national income that are plausibly exogenous and independent on technological change using a panel of more than 139 countries from 1960 to 2007. Incorporating changes in international oil prices with countries' average net oil export shares in GDP and controlling for county and fixed effects, the study revealed that the growth in income induced by oil prices positively impacts on population growth.

Blanchet et al., (1991) undertook a study on population and economic growth in Less Developed countries for three different time periods 1950-1960, 1960-1970, and 1950-1970 by adopting Ordinary Least Square Estimation on linear multivariate regression. Their study found unequivocal significant positive effect of population density on per capita income growth (economic growth) whiles population growth rate was found to have no effect on economic growth for all the three time periods.

Rosenzweig (1990) conducted a study on human capital, population growth and economic development: beyond correlations, employed economic-biological model of household behavior on data from selected countries such as United States, Columbia, India, Indonesia, Malaysia and Philippines and found that difficulty in controlling fertility contributes to lower level of human capital, and any conscious effort to minimize the cost of fertility control also increases human capital level which are favorable for economic development.

Bloom and Canning (2001) and Kalemli-Ozcan (2002) have empirical evidence which suggests that in contemporary developing countries, decline in mortality rate promotes economic growth since it increases investment in physical and human capital as a result of increase in savings rate and education.

Dao (2012) similarly applied Least Square Estimation on linearly multivariate regression using data on forty-three developing countries to analyze population and economic growth in developing countries. He used GDP per capita as explained variable whiles explanatory variables include population growth, fertility rate, urbanization, old dependency ratio, young dependency ratio, and population growth and whether or not the rate of population growth is less than 1.2 percent per year. He found that economic growth linearly and negatively depends on population

growth but fertility rate and urban growth were found to be statistically insignificant interaction with planned family planning and significant socio-economic structural changes.

Onwuka (2006) empirically investigated the relationship between population growth and economic development in Nigeria between 1980 and 2003 by employing the OLS technique. His study empirically found out that growth in population outweighed that of output and that this had negatively affected development in the country because a considerable proportion of the nation's resources were consumed rather than being accumulated for development purposes.

Bloom and Williamson (1998) empirically found that population dynamics explained almost 20 per cent of the growth observed in Europe over the time period of 1965-1990. They proposed the distinct channels through which demography may influence growth as the labour force, savings and investment, and then found a significant interaction between demographic variables and policies. Their study suggests that good policies led to higher growth and the impact of demographic change was greater when institutions were of higher quality. Similarly, Bloom, Canning and Sevilla (2003b) stressed that open economies, a flexible labour force and modern institutions were necessary for a country to actually reap the demographic dividend.

Boadu (1994) also investigated the relationship between population and economic growth for the economy of Ghana on four key variables namely Education, Health, Environment and the economic sector. His study found a negative relationship between population growth and economic growth. He suggests a reduction in the size of Ghana's population growth if it were to achieve a sustainable growth and a quality of life for its populace.

Marsiglio et al., (2012) investigated the impact of demographic change on both economic short and long run dynamics within an enlarged Lucas-Uzawa model with intratemporal altruism. The study points out that the long run level effect of population size on per capita income is negative

while its growth effect is zero .The study also reveals that there was a negative effect of population growth on per capita income in the initial periods and a positive effect which restores a positive correlation between population growth and economic performance. Hence the model replicates a complicated time relationships between economic and demographic changes.

Thuku et al., (2013) investigated the relationship between population change and economic growth. They employed the Vector Autoregression Estimation technique for an annual time series data between the period 1963 to 2009.Their study revealed that population growth has a positive impact on economic growth and subsequently promotes development in Kenya.

Eze and Eze (2014) investigated the effects of population growth on economic growth. The study used GDP growth per capita as a proxy for the economic growth. ARDL test to Cointegration was employed for the analysis. The study revealed a long-run sustainable equilibrium between the economic growth and population growth through the use of the ARDL. The study again revealed a unidirectional causality between the population and the economic growth through the use of pairwise Granger Causality test technique.

3.3 Summary of Chapter

The foregoing discussion on literature review reveals very interesting dimensions to the linkage between population and economic growth. From the theoretical literature reviewed, the relationship between population and economic growth was found to be either positive or negative. There is also the evidence of a unidirectional and bi-directional causality between population and economic growth. Furthermore, analysis from available empirical literature indicates that it may not be possible on apriori grounds to arrive at any firm conclusion on the directional causality between the variables. In modeling the relationship between population

growth and economic growth, the study reviewed from literature that both time series data and panel data were employed by numerous authors. The issue is basically empirical and critically depends on the type and nature of an economy being considered. It can also be inferred that all the literature's reviewed on the subject provides mixed evidence and as a result there is the need to investigate the direction of causality for the case of Ghana which will serve as a guide to policy makers and the Government as to the key role played by population growth in the economic growth of the country.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This chapter outlines the methodology used and the source of data for the study. Section 4.2 presents the theoretical framework within which the study is carried out while section 4.3 presents the empirical estimation procedures as well as description of all variables and expected signs of variables used. Whiles section 4.4 presents the data source for the study, Section 4.5 presents techniques for estimation and the diagnostic test is presented in section 4.6. Section 4.7 captures the concluding remarks of the chapter.

4.2 Theoretical Framework

There are different studies related to population growth and economic growth in the literature where different researchers have used different variables which affect economic growth and related population growth. The seminal theoretical models, which are the basis for most modern population and economic growth models, were first derived by Smith (1966), Kuznets (1967), Simon (1977), Kelly (1988) and many more. This models study the link between population and economic growth.

To investigate the effect of population growth on economic growth, the specification usually adopted for national-level studies by earlier growth researchers such as Acemoglu and Johnson (2006) is the aggregate production function (APF) which is the traditional Cobb-Douglas production function specified as follows:

$$Y = AL^{\beta_1}K^{\beta_2} \quad (4.1)$$

Where:

$Y =$ Output, $K =$ Capital, $L =$ Labour force and $A =$ Total factor productivity (TFP), $\beta_1$and β_2 are output elasticities of labour and capital

From equation (4.1), we can conclude that;

$$Y = f(A, KL) \quad (4.2)$$

As per the endogenous growth theory, total productivity (A) is determined endogenously by economic factors.

The aggregate production function assumes that, along with "conventional inputs" of labour and capital used in the neoclassical production function, "unconventional inputs" like population growth may be included in the model to capture their contribution to economic growth.

Assuming constant technology, an increase in the amount of capital and/or labour will increase the level of output in the economy. In this regard, Total Factor Productivity (A) captures growth and output not accounted for by the changes in labour and capital. However, the study seeks to investigate the effect of population growth on economic growth; the Total Factor Productivity is a function of population growth and other macroeconomic factors such as population density, unemployment rate, and gross capital formation.

From equation (4.2)

$$A = f(POPG, POPD, UR) \quad (4.3)$$

Where $POPG =$ Population Growth, $POPD =$ Population density and $UR =$ Unemployment rate,

By substituting equation (4.3) into equation (4.1)

$$Y = L_t^{\beta_1} K_t^{\beta_2} POPG_t^{\beta_3} POPD_t^{\beta_4} UR_t^{\beta_5} \quad (4.4)$$

Where $\beta_1, \beta_2, \beta_3, \beta_4, and\ \beta_5$ are the elasticity coefficients of output for $L_t, K_t, POPG_t,\ POPD_t\ and\ UR_t$ respectively

From equation (4.4), taking the natural log of both sides

$$LNY_t = \beta_0 + \beta_1 LNL_t + \beta_2 LNK_t + \beta_3 LNPOPG_t + \beta_4 LNPOPD_t + \beta_5 LNUR_t + \mu_t \quad (4.5)$$

Where all coefficients and variables are as defined, β_0 is a constant, LN is a logarithmic operator and μ_t is the stochastic error term.

4.3 Empirical Model

Following from Dao's model (2012) and other works such as Afzal et al. (2010), Bloom et al. (2004), the empirical model to be estimated is presented as:

$$\ln GDPG_t = \alpha_0 + \alpha_1 \ln POPG_t + \alpha_2 \ln POPD_t + \alpha_3 \ln LF_t + \alpha_4 \ln UR_t + \alpha_5 \ln GKF_t + \mu_t \quad 1$$

$\boldsymbol{\alpha_1}$, $\boldsymbol{\alpha_2}$, $\boldsymbol{\alpha_3}$, $\boldsymbol{\alpha_4}$, and $\boldsymbol{\alpha_5}$ are co-efficient to be determined and $\boldsymbol{\alpha_0}$ is a constant. **ln** represents the natural logarithm and $\boldsymbol{\mu_t}$ is white noise where

LnGDP denotes the log of Gross Domestic Product (GDP), lnPOPG denotes log of Population Growth, lnPOPD denotes log of Population Density, lnLF denotes log of Labour Force, lnUR

denotes log of Unemployment Rate and lnGKF denotes log of Gross Capital Formation of Ghana.

The variable GKF_t, Gross Capital Formation (previously Gross Domestic Investment) is used as a proxy for capital in equation (4.5) due to the lack of reliable data for capital stock.

The dependent variable $GDPG$ represents the level of per capita GDP for each period of the study. The dependent and independent variables are logarithmized to ease the interpretation of the coefficients as elasticity. The empirical model in (1) is in line with other studies done by Afzal et al., (2010) and Dao (2012).

POPG which denotes Population growth refers to the rate at which the population of a country changes over time. It is measured as the sum of crude natural rate of growth (Crude birth rate less of crude death rate) and net migration (difference between emigration and immigration). The higher the crude rate of growth and net migration, the higher the population will be. High population provides high number of labour force that might promote economic growth and leads to economic development. But the increase in labour force is not sufficient for economic growth. It is the high employment rate and Human Resource Development (HRD) with the increase in labor force that ensures economic growth. The study expects a negative relationship between population growth and economic growth. According to studies such as Afzal (2009) Brander and Dowrick (1994) and Dao (2012) population growth has a negative relationship with economic growth.

The variable POPD is population density which refers to the number of persons residing in a particular unit area of land per square kilometer and measured as the number of people per square kilometer of land area. It is expected to be positively related with the level of per capita

GDP. This can be explained on the bases that, in Ghana major cities such as Accra, Tema, Kumasi and Takoradi and so on, are densely populated. These cities served as large and concentrated market centres allowing for economies of scale in the production of manufactured goods at a relatively low transportation cost. This is due to the fact that firms in these urban areas can better match their labour demands with the supply of skills, while the return to infrastructure such as roads, port facilities and electricity grids are greater due to the concentration of industries and firms. With the easy access to factors of production at a relatively cheaper cost, production of goods and services can conveniently take place. According to Hamza (2008), population density exhibits a positive relationship with population growth.

The variable LF represents labour force. It measures the size of the active population that falls within the age brackets of 15 and 65 years respectively. It determines the supply of labour readily available for the production of goods and services in an economy. The economically active population constitutes the labour force in the country. According to production theory, an increase in labour force will lead to an increase in output. According to Frimpong and Oteng (2010), labour force is one of the most important factors that aid economic growth. This is possible because when the labour force is gainfully employed they produce to add up to the Country's GDP growth. The coefficient of LF (α_3) demonstrates the relationship between labor force and per capita GDP which is expected to be positive ($\alpha_3 > 0$). Frimpong and Oteng (2010) reported a positive relationship between labour force and economic growth.

The variable UR denotes unemployment rate. It refers to the number of persons willing and legible to work but could not find any at the going market wage rate. An increase in unemployment rate hampers economic growth as being demonstrated by the Okun's law

(Prachowny, 1993). The law states that the variations in unemployment are inversely related to variations in output in an economy. The coefficient of UR measures the effect of changes in the unemployment rate on the level of per capita GDP. The study expects a negative relationship between unemployment and population growth. This is so because Ghana is a developing country with a huge labour force and a corresponding high rate of unemployment. However economic growth comes as a result of the employment and utilization of the active labour force available in the production process .These workers who are gainfully employed however produce which make up for our GDP growth. They also pay taxes and also save part of their incomes earned which can be channeled into investment which will lead to a further increase in the GDP. It is therefore expected that, the higher the employment rate, the higher the GDP growth would be and the higher the unemployment rate the lower the GDP growth would be" Other things being equal''. According to Furouka and Adewole (2012), unemployment rate has a negative effect on economic growth.

The variable GKF is Gross capital formation (previously gross domestic investment). Gross capital formation is used as a proxy for capital due to the lack of reliable data for capital stock. It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories which aids production of goods and services. The Fixed assets include land improvement (fences, ditches, drains and many more); plant, machinery and equipment purchases; and the construction of roads, railways and others including schools, offices, hospitals, and private residential dwellings, commercial and industrial buildings. On the other hand, Inventories are stocks of goods held by firms to meet temporal or unexpected fluctuations in production or sales, and "work in progress". According to the SNA, Kendrick (2012), net acquisitions of valuables are also considered capital formation. This has been used in previous studies by Barro and Lee (1993) and Li and Liu (2005). According to production theory, an

increase in capital will lead to **a**n increase in Investment and a corresponding increase in real GDP. The expected sign of capital (α_5) is positive.

4.4 Data Type and Sources (2014)

The study employed secondary data sourced from the World Development Indicators (WDI, 2013) with reference period of 1980-2013 as a result of data availability. Over the period, Ghana started experiencing a decline in its GDP growth (negative) from 1981-1983 as a results of economic recession that occurred in 1981. Since then it is worthy to note that the economy has recovered but suffered series of fluctuations which does not match the rate at which the population grows.

4.5 Estimation Technique

The study employed time series data for the analysis. One problem often associated with time series data is non-stationarity. The use of non-stationary variables is likely to give misleading results. This study therefore begins its estimation process by first testing for unit roots.

4.5.1 Unit Root Test

A unit root test is performed on the variables considered in the study. This is due to the fact that most macroeconomic time series data are non-stationary and regressing non-stationary series on each other is bound to produce spurious regression result as specified by Granger and New Bold (1974). The Unit root test is also performed to know whether the variables exhibit certain characteristics such as the mean reversion and finite variance.

It is appropriate to test the time series to ascertain whether they are stationary or non-stationary as well as their order of integration. The order of integration is essential because it helps in

determining the subsequence long run relationship among the variables. The Philip-Peron (PP) test proposed by Philips and Peron (1988) was employed for the unit root test.

The PP test is based on the ADF regression and the critical values are the same as those used for ADF tests.

$$\Delta X_t = \delta_0 + \delta_1 X_{t-1} + \delta_2 T + \sum_{i=1}^{n} \varphi_I \Delta X_{t-1} + \varepsilon \quad (4.6)$$

Where Δ is the difference operator, X is the natural logarithm of the series, T is a trend variable, δ and φ are the parameters to estimate and ε is the error term. The Philip-Peron (PP) test was employed for the study because of its advantage over the Augmented Dickey Fuller (ADF) test due to the following reasons.

- The PP gives robust estimates when the series are serially correlated and also suffer from time-dependent heteroscedasticity.
- The PP test does not require the assumption of the homoscedasticity of the error term (Philips and Perron, 1988).
- There is no loss of effective observation from the series based on the fact that, lagged terms of the variables are set to zero (Peron, 1997).

The null hypothesis is that the series is non-stationary and this is either accepted or rejected based on the t-ratio of the lagged term X_{t-1} compared to the tabulated values. If the t-ratio is greater than the critical value, the null hypothesis of the Unit root (i.e. the series is non-stationary) is rejected. On the other hand if the t-ratio is less than the critical value, the null hypothesis of a Unit roots (i.e. the series is non-stationary) is accepted.

The first difference of the series is obtained by the use of equation (4.6) and if the null hypothesis is rejected the series is said to be stationary and conclusion is that the series is integrated of order I (1). The critical values of the t-statistics are given in Jorm et.al ,(1991). A unit root test is thus performed for each variable on both levels and first difference. The first differences of the variables are investigated for the existence of Unit root.

However, the problem associated with differencing the variables is the possibility of losing long run information present in the variables (Brox and Malik, 2010).To avoid this problem, the study will adopt the Autoregressive Distributed lag Modeling Approach to Cointegration which shows the long run relationship among the non-stationary series.

4.5.2 Autoregressive Distributed Lag (ARDL)

The Autoregressive Distributed Lag (ARDL) Bound Testing approach developed by Pesaran et al. (1999) was used to test the long run and short run relationship between population and economic growth and its determinants used in this study. This approach is used to determine the long run and short run relationship irrespective of whether the independent variables are integrated of order zero I(0), one I(1) or mutually cointegrated. The dependent variable has to be integrated of order one I(1) and the independent variables should not be integrated of order two I(2) or higher before the Autoregressive Distributed Lag (ARDL) Bounds Testing approach can be used.

Justification of the Autoregressive Distributed Lag (ARDL) Bounds Testing Approach

There are a lot of methods used for testing the existence of a long run relationship between time series variables. The most commonly used Cointegration techniques are the two –step residual

based procedure by Engle and Granger(1987) and the system based reduced rank regression technique by Johansen (1991),Johansen and Foss(1995).

Other technique such as stochastic common trends approach by Sims et al., (1990) and the variable addition approach developed by Park (1990) can also be used for testing for the existence of long run relationship between the variables. The above mentioned techniques have one common limitation of requiring all the time series variables to be integrated of order one I (1). This according to Pesaran et al., (1999) introduces a certain degree of uncertainty and also some degree of pretesting into the long run relationship.

The Autoregressive Distributed Lag (ARDL) Bound testing technique is preferred to the other conventional Cointegration techniques due to the following under listed factors which necessitates my choice of this model.

- ARDL models generate consistent estimates of long- run coefficients that are asymptotically normal, regardless of whether the variables are purely I(0), purely I(1) or mutually cointegrated (Pesaran et al.,2001).
- The technique (ARDL) provides unbiased and efficient estimates of the long-run model and valid t-statistics even in situations when the variables are endogenous. This is possible because it avoids the problems of serial correlation and endogeneity (Afzal et al., 2010).
- ARDL models are suitable for small sample sizes, unlike other VAR methods like the Johansen cointegration technique which in the same situation would result in considerable loss of degrees of freedom (Banerjee et al., 1993).

- The ARDL technique uses a single equation making it easier and simpler to interpret unlike the other VAR approaches which involves several equation setups.

Autoregressive Distributed Lag (ARDL) Cointegration Modeling Procedure

The bounds testing approach developed by Pesaran et al., (2001) is used to test for the presence of a long-run relationship among the variables in this study. The bounds testing approach employ the Autoregressive Distributed Lag (ARDL) models. The bounds testing procedure basically follows three steps.

To carry out the bounds test procedure, equation (1) is modeled as a conditional ARDL-error correction model stated below:

$$\Delta \ln Y_t = \sum_{i=1}^{p} b_i \Delta \ln Y_{t-1} + \sum_{i=0}^{p} c_i \Delta \ln POPG_{t-1} + \sum_{i=0}^{p} d_i \Delta \ln POPD_{t-1} + \sum_{i=0}^{p} e_i \Delta \ln LF_{t-1} +$$

$$\sum_{i=0}^{p} f_i \Delta \ln UR_{t-1} + \sum_{i=0}^{p} g_i \Delta \ln GKF_{t-1} + U_t + Ø_1 \ln Y_{t-1} + Ø2 \ln POPG_{t-1}$$

$$\phi 3 \ln POPD_{t-1} + \phi 4 \ln LF_{t-1} + \phi 5 \ln UR_{t-1} + \phi 6 \ln GKF_{t-1} + \varepsilon_t \qquad (4.7)$$

Where, Δ denotes the first difference operator, α_0 is the drift parameter and ε_t is the white noise error term. To determine the existence of cointegration, we first estimate the first differenced of the above equation using ordinary least squares technique (OLS) as adopted by Sohn and Kim (1997). The Akaike Information Criterion (Akaike, 1981) is employed to select the optimum number of lags. We then ascertain the long-run relationship by restricting the coefficients of the lagged level variables to zero. The null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration among the variables.

That is;

$$H_0: Ø_1 = Ø_2 = Ø_3 = Ø_4 = Ø_5 = Ø_6 = 0$$

$$H_1: Ø_1 \neq Ø_2 \neq Ø_3 \neq Ø_4 \neq Ø_5 \neq Ø_6 \neq 0$$

The null hypothesis is tested against the alternative by means of an F- test with an asymptotic non- standard distribution. Considering the ARDL approach, two asymptotic critical value bounds provide a test for cointegration when the independent variables are I(d) with $0 < d < 1$ (Pesaran and Smith,1995). The lower bound on the one hand, assumes that all the Regressors are I(0) and the upper bound on the other hand, assumes that they are I(1).

If the F-statistic computed lies above the critical upper bound value, we reject the null hypothesis regardless of the cointegration rank of the variables, indicating the existence of cointegration among the variables. However, if the computed F-statistic lies below the lower critical bound value, we fail to reject the null hypothesis of no cointegration relationship among the variables, implying the absence of long-run relationship. No conclusive decision is made when the F-statistic falls within the critical bound values. The critical values developed by Pesaran et al. (2001) are based on simulated large sample size. Therefore, this study uses the critical values developed by Narayan (2004), since it is more appropriate for small samples.

The estimated model is as follows:

$$1nY_t = \alpha 0 + \sum_{i=1}^{n1} \beta_i \, 1nY_{t-i} + \sum_{i=0}^{n2} \gamma_i \, 1nPOPG_{t-i} + \sum_{i=0}^{n3} \delta_i \ln POPD_{t-i} + \sum_{i=0}^{n4} \phi_i \ln LF_{t-i} + \sum_{i=0}^{n5} \lambda_i \ln UR_{t-i} + \sum_{i=0}^{n6} \theta_i \ln GKF_{t-i} + \mu_t \quad (4.8)$$

This is followed by the estimation of the short-run elasticities of the variables with the error correction representation of the ARDL, model. By employing the error correction of the ARDL, the speed of adjustment to equilibrium is determined. The existence of long–run relationship among the variables necessitates the estimation of the unrestricted ARDL-error correction represented as:

$$\Delta 1nY_t = \alpha_0 + \sum_{i=1}^{n1-1} b_i \Delta 1nY_{t-i} + \sum_{i=0}^{n2-1} c_i \Delta 1nPOPG_{t-i} + \sum_{i=0}^{n3-1} d_i \Delta 1nPOPD_{t-i} + \sum_{i=0}^{n4-1} e_i \Delta 1nLF_{t-i} + \sum_{i=0}^{n5-1} f_i \Delta 1nUR_{t-i} + \sum_{i=0}^{n6-1} g_i \Delta GKF_{t-i} + \boldsymbol{\lambda} ECM + \mu_t \quad (4.9)$$

ECM is the error correction term and its coefficient (λ) is the speed of adjustment to the long-run following a shock to the system. It is expected to be negative and statistically significant so as to confirm the existence of cointegration among the variables in the model.

4.6 Diagnostic Tests

The reliability of the goodness of fit of the model is determined by conducting the diagnostic and stability tests of the model. The test is carried out to test the robustness of the results from the ARDL model. The diagnostic test takes care of heteroscedasticity, autocorrelation, normality and the functional form that are linked to the model. According to Pesaran and Shin (1998) the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) are employed in performing parameter stability tests.

4.7 Concluding Remarks

This chapter explored the main theoretical underpinning for the study. Based on theory and empirical studies a number of variables which are thought of influencing economic growth have been included in the model of the current study. The chapter also dealt with the issue of variable description measurement, justification for their choice as well as their *apriori* economic expectation. The variables employed in the model are population growth, labour force, gross capital formation, population density and unemployment rate. Further, empirical models and econometric estimation techniques relevant to the study have been specified and discussed. Discussion on the various sensitivity analyses aimed at ensuring the fitness of variables and models have also been made. By this, the chapter has set a good platform for the estimation and discussion of results.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Introduction

This chapter presents the results of the study and their discussions.

5.2 Unit Root and Stationarity Testing

The Philip-Peron and Augmented Dickey-Fuller unit root testing approaches were employed to ascertain whether the variables employed in the model were free of unit root. Although for the Autoregressive distributed lag (ARDL) approach to cointegration does not require pre-testing of the variables for the presence of unit root, the study undertook the test to ascertain that the variables are not integrated of order greater than one.

Philip-Peron Unit Root Test Results (PP) and Augmented Dickey-Fuller (ADF);

The hypothesis underpinning the PP and ADF unit root testing is specified as;

H_O: variable has unit root [I (1)]

H_A: variable has no unit root [I (0)]

Decision criteria; if the absolute t-calculated is greater than the absolute of the critical value at 5% significant level which was chosen by this study, reject the null hypothesis. That is we accept the alternate hypothesis of the variable been stationary.

Table 5.1: Augmented Dickey-Fuller (ADF) Unit root test Results

Source: Author's computation (2015)

Variable	DETERMINANTS	ADF (LEVEL)			ADF AFTER FIRST DIFFERENCE		
		T-statistics	CV (5%)	Decision	T-statistics	CV (5%)	Decision
LGDPG	Constant	2.659	2.954	I(1)	5.271	2.957	I(0)
	Constant+ Trend	3.272	3.553	I(1)	5.195	3.558	I(0)
LGFK	Constant	5.506	2.954	I(0)	8.897	2.957	I(0)
	Constant+ Trend	6.206	3.553	I(0)	8.747	3.557	I(0)
LPOPD	Constant	7.722	2.954	I(0)	4.439	2.960	I(0)
	Constant+ Trend	3.181	3.553	I(1)	4.291	3.563	I(0)
LLF	Constant	0.062	2.954	I(1)	5.735	2.960	I(0)
	Constant + Trend	1.773	3.553	I(1)	5.638	3.563	I(0)
LUR	Constant	0.342	2.954	I(1)	6.589	2.957	I(0)
	Constant + Trend	1.903	3.553	I(1)	7.613	3.558	I(0)
LPOPG	Constant	0.779	2.954	I(1)	5.275	2.957	I(0)
	Constant + Trend	3.402	3.553	I(1)	4.676	3.557	I(0)

The result of the ADF is presented in the Table 5.1 depicts that log of gross capital formation (LGKF)was the only variable which was stationary at level, the rest were stationary after first differencing at 5% (0.05) significant level.

Table 5.2: Philip-Peron Unit Root test Results

VARIABLE	DETERMINANTS	PP (LEVEL)			PP (AFTER FIRST DIFFERENCE)		
		T-Statistic	CV (5%)	Decision	T-Statistic	CV (5%)	Decision
LGDPG	Constant	-2.297	-2.954	I(1)	-7.790	-2.957	I(0)
	Constant + Trend	-3.144	-3.553	I(1)	-10.860	-3.558	I(0)
LGFK	Constant	-5.501	-2.954	I(0)	-19.723	-2.957	I(0)
	Constant + Trend	-6.327	-3.553	I(0)	-18.859	-3.558	I(0)
LPOPD	Constant	-7.722	-2.954	I(0)	-4.439	-2.960	I(0)
	Constant + Trend	-3.180	-3.553	I(1)	-4.291	-3.562	I(0)
LLF	Constant	-0.063	-2.954	I(1)	-5.734	-2.960	I(0)
	Constant + Trend	-1.773	-3.553	I(1)	-5.638	-3.563	I(0)
LUR	Constant	-0.341	-2.954	I(1)	-6.589	-2.957	I(0)
	Constant + Trend	-1.903	-3.553	I(1)	-7.614	-3.558	I(0)
LPOPG	Constant	-0.779	-2.954	I(1)	-5.275	-2.957	I(0)
	Constant+ Trend	-3.402	-3.552	I(1)	-4.676	-3.558	I(0)

Source: Author's Computation

Table 5.2 presents the result of the Philip-Peron's unit root test for stationarity. It can be inferred from the Table that only the log of the gross capital formation was stationary at levels. All the other variables were stationary after first differencing at 5% (0.05) significance level.

Table 5.3: Descriptive Statistics of variable used for analysis

Variables	Mean	Std.Dev.	Minimum	Maximum
LLF	71.262	2.164	68.358	75.500
LGDPG	2.434	0.547	-0.000	3.132
LGKF	2.895	0.688	-0.000	4.094
LPOPD	4.322	0.261	3.860	4.734
LPOPG	0.964	0.124	0.742	1.248
LUR	1.497	0.663	-0.039	2.341

Source: Author's computation (2015)

The Table 5.2 presents the descriptive statistics of the variables used for the analysis. All the variables both the dependent and the independent were employed in the model. This is due to the

fact that they were all stationary after first differencing. The dependent variable is GDP per capita (LGDPG) and the independent variables are Labour force (LLF), Gross capital formation (LGKF), Population density (LPOPD), Population growth (LPOPG), and Unemployment rate (LUR). The mean and standard deviation of the LLF are 71.262 and 2.164 respectively. The mean and standard deviation of LGDPG, LGKF, LPOPD, LPOPG and LUR are (2.434, 2.895, 4.322, 0.964, 1.497) and (0.547, 0.688, 0.261, 0.124, 0.663) respectively. The mean denotes the averages of the variables over the time period chosen for the study whereas the standard deviation captures the deviation of the minimum and maximum values of the variables from the mean. The standard deviations capture the dispersion of the independent variables used in the model around their respective means

5.3 Results of Co-integration

The study undertook co-integration test to ascertain whether there is a long-run relationship between the dependent and the independent variables used. The null hypothesis states that there is no long run relationship or no co-integration among the variables against the alternative of long-run relationship among the variables. The Ward Bound Testing technique was employed for the test with intercept and no trend. The result is presented in Table 5.3.

The test produced an estimated F-calculated of 10.481. This F-statistic is then compared with the lower and upper bound values of the Pesaran table of critical values of Pesaran et.al (2001). Per the criteria, if the F-statistic is less than the lower bound value, the null hypothesis of no co-integration among variables is not rejected. On the other hand, if the F-calculated is between the lower bound value and the upper bound value, the test is deemed inconclusive, in which case a different approach such Johansen co-integration and Engel Granger techniques must be employed. However if the F-statistic estimated is greater than the upper bound value, the null

hypothesis of no co-integration is rejected. In this study, the F-calculated of 10.481 is greater than the critical value at 1% (0.01) and so the null hypothesis was rejected, implying that there is co-integration or long-run relationship among the variables. Due to this, the Error correction model deemed fit to be used to examine the short run dynamics. Once we establish that the variables are cointegrated, we proceed to estimate the long-run ARDL model in order to obtain the long-run coefficients and their asymptotic standard errors.

Table 5.4: Results of the Bound Testing for Cointegration

Null hypothesis	**F-statistic**	**Critical bond values; with intercept and no trend K=2, N=31**					
		10%level		5%level		1%level	
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
$c_1 = c_2 = c_3 = c_4 = c_5 = 0$	10.481***	3.17	4.14	3.79	4.85	5.15	6.36

Source: Author's Computation (2015)

Estimation of Long-Run Coefficients using the ARDL Approach

This section presents the results from the Long-run ARDL estimation. The empirical result is presented in table 5.5.

Table 5.5: Discussion of Long-Run Coefficients using the ARDL Approach Based on Akaike Information Criterion (1, 1, 1, 0, 0, 1) Dependent variable is LGDPG

Variables	Coefficient	Standard Error	T-ratio	P-value
LGKF	0.024	0.660	0.366	0.718
LLF	1.730***	0.473	3.659	0.001
LPOPD	1.642***	0.299	5.493	0.000
LPOPG	-0.345***	0.881	-3.918	0.001
LUR	-0.728***	0.101	-7.190	0.000

Test statistics	LM Version	F Version
A. serial correlation	CHSQ (1) = 0.338(0.561)	F(1,23) = 0.238(0.630)
B. Functional Form	CHSQ(1) = 13.102(0.143)	F(1,23) = 15.145(0.223)
C. Normality	CHSQ(2) = 0.836(0.658)	Not Applicable
D. Heteroscedasticity	CHSQ(1) = 1.950(0.163)	F(1,31) = 1.947(0.173)

A. :Lagrange Multiplier test of Residual serial correlation
B. :Ramsey's RESET test using the square of the fitted values
C. :Based on the test of skewness and kurtosis of residuals
D. :Based on the regression of squared residuals on squared fitted values

Source: Author's computation R-squared = 0.923 R-Bar-squared = 0.898 F-stat. F(8,24) = 36.376 Prob> (F-statistic) = 0.000

The R-squared of 0.923 indicate that about 92.3 percent of the variation in the dependent variable ($GDPG_t$) can be explained by the independent variables. The probability of F-statistic is 0.000 implying that it is significant at less than 1 percent. This indicates that the model specification for the analysis best fits.

The empirical results as presented in Table 5.4 indicates that in the long-run, log of labour force

(LLF), log of population density (LPOPD), log of population growth (LPOPG) and the log of unemployment rate (LUR) were statistically significant. This implies these variables had a significant influence on LGDPG.

The long-run result shows that the effect of population growth on economic growth is negative and significant at 1% level. The empirical result implies that 1 percent increase in population growth (LPOPG) will lead to 0.345 percent decrease in economic growth (LGDPG) in Ghana. This result is line with the study's expectation which stated that population growth has a negative effect on economic growth of Ghana. This is based on the fact that as population increases the dependent population also increases. The dependent population comprises of the people below 15 years and above 65 years. Since those above 65 years are not economically active and it also takes time for those below 15 years to mature to become economically active. At this point in time they are entirely dependent on the active labour force for their livelihood. This is because at this stage they do not produce anything to add up to GDP growth but rather consume what already exist. This is consistent with Afzal (2009) who revealed that population has a negative effect on economic growth. The empirical result is also consistent with Brander and Dowrick (1994) who reported a negative relationship between population growth and economic growth. The empirical result again corroborates with Dao (2012) who revealed that population has negative impact on economic growth. Other past studies (e.g. Birdsall and Sinding 2001; Barro and Sala-i-Martin ,2004; Sachs (2008; Headey and Hodge ,2009) studied the effect of population growth on economic growth and all concluded that rapid population growth exerts negative significant impact on economic growth in developing countries.

The empirical results showed that population density (POPD) had a positive relationship with economic growth. The result indicates that 1 percent increase in population density will lead to 1.642% increase in economic growth in Ghana. The result coincides with the study's expectation which stated that population density has a positive relationship with economic growth. The empirical result can be explained that, in Ghana cities like Accra, Tema, Kumasi and Takoradi and so on are densely populated. These cities provide large and concentrated market, allowing for economies of scale in the production of manufactured goods at a relatively low transportation cost. It is in these urban areas that firms can better match their labour demands with the supply of skills, while the return to infrastructure such as roads, port facilities and electricity grids are greater due to the concentration of industries and firms. With the easy access to factors of production at a relatively cheaper cost, production of goods and services can conveniently take place. The empirical result is consistent with Hamza (2008) who also reported a positive link between population density and economic growth

The empirical results further showed that the labour force (LF) had a positive relationship with economic growth and significant at 1 percent. This implies that 1 percent increase in the labour force of Ghana leads to 24.6 percent increase in the economic growth. The result coincides with the study's expectation which stated that there is a positive relationship between labour force and economic growth. The empirical result can be explained on the base that as Ghana is a developing country and has a huge supply of labour force, labour can readily be obtained at a relatively cheaper cost by firms for production. When this happens their cost of production may relatively be low so there is the incentive to expand their production levels in the long run which may increase the level of GDP. This will motivate the industries to employ more labour to

increase the level of output. This result is consistent with Arif and Chaudhry (2008) who revealed that human capital has a positive relationship with economic growth.

The empirical result showed that the unemployment rate (UR) had a negative relationship with economic growth and significant at 1 percent. This implies that 1 percent increase in the unemployment rate in Ghana leads to 1.22 percent decline in the economic growth. This is so since Ghana is a developing country with high rate of unemployment problems, its huge active labour force is underemployed and as such the unemployed are not producing anything to be added to the GDP growth. The result is coincides with the study's expectation which stated that there is a negative relationship between unemployment rate and economic growth. The empirical result corroborates with Ali et al., (2014) who revealed that there is a negative relationship between unemployment rate and economic growth as well as Zaman et al., (2009) and Adewole (2012).

Although the log of gross capital formation (LGFK) was not statistically significant but exhibits a positive relationship with economic growth.

Results from Error correction model (ECM)

This section presents the results from the error correction model.

Table 5.6: Error Correction Representation for the selected ARDL Model ARDL (1,1,1,0,0,1) selected based on Akaike Information Criterion

Variable	Coefficient	Std. Error	t-statistic	Prob.
LGKF	0.464***	0.052	8.795	0.000
LLF	1.734***	0.465	3.727	0.001
LPOPG	-3.504***	0.908	-3.857	0.001
LPOPD	1.372***	0.243	5.637	0.000
LUR	-0.020	0.055	-0.336	0.717
ECM(-1)	-0.836***	0.121	-6.897	0.000

R-Squared	.89714	R-Bar-Squared	.86285
S.E. of Regression	.17613	F-stat. F(5, 27)	41.8656[.000]
Mean of Dependent Variable	.017699	S.D. of Dependent Variable	.47561
Residual Sum of Squares	.74455	Equation Log-likelihood	15.7344
Akaike Info. Criterion	6.7344	Schwarz Bayesian Criterion	.1471E-3
DW-statistic	2.1283		

Source: Authors Computation (2015) **** signifies 1% significant level*

Model specification for the Error Correction

$$ECM = LGDPG - 0.024166LGKFI - 1.7304LLF - 1.6420LPOPD + .72832LUR + 3.4495LPOPG$$

The error correction model of -0.836, which is statistically significant at 1 percent significance level. This helps to reinforce the findings of the long-run relationship among the variables in the model. The magnitude of the coefficient of the error term (ECM) signifies that 83.6% of deviations from the equilibrium level of economic growth (LGPDG) are corrected each year. Furthermore, an R-squared of 0.897 suggests that the explanatory variables included in the model explain 89.7 % of the level of economic growth. The remaining 10.3 percent is accounted for by variables excluded in our economic growth model and which are accounted for by the

error term. The probability of F-statistic is 0.000 implying that it is significant at less than 1 percent. This indicates that the model specification for the analysis best fits.

The gross capital formation (GKF) was statistically significant at 1 percent significance level. It had a positive relationship with the economic growth in the short-run. This implies that 1 percent increase in the gross capital formation in Ghana will lead to 0.464 percent increase in the economic growth. The result is consistent with the study's expectation which stated that gross capital formation has a positive relationship with economic growth. The empirical result can be interpreted on the bases that as gross capital formation increases in the Ghanaian economy it will result in a higher investment leading to further increase in output which will increase the GDP. The empirical result corroborates with Barro and Lee (1993) and Li and Liu (2005).

The result showed that impact of population growth on economic growth is negative and statistically significant at 1% significant level. The empirical result implies that 1 percent increase in population growth of Ghana (LPOPG) will lead to 3.504 percent decrease in economic growth (LGDPG). This result is agrees with the study's expectation which stated that population grow has a negative effect on economic growth of Ghana. This is based on the fact that as the population increases, the young population (below 15 years) also increases along with it and as such takes time for them to mature to become economically active. At this point in time they are entirely dependent on the active labour force for their livelihood. This is because at this stage they do not produce anything to add up to GDP growth but rather consume what already exist. This coincides with Afzal (2009) who revealed that population has a negative effect on economic growth. The empirical result is also consistent with Brander and Dowrick (1994) who reported a negative relationship between population growth and economic growth. The empirical

result again corroborates with Dao (2012) who revealed that population has negative impact on economic growth.

The empirical results further showed that the labour force (LF) had a positive relationship with economic growth and significant at 1 percent. This implies that 1 percent increase in the labour force of Ghana leads to 1.734 percent increase in the economic growth. The result coincides with the study's expectation which stated that there is a positive relationship between labour force and economic growth. The empirical result can be explained on the bases that as Ghana is a developing country and has a huge supply of labor force, labour can readily be obtained at a relatively cheaper cost by firms for production.

The empirical results showed that population density (POPD) had a positive relationship with economic growth. The result indicates that 1 percent increase in population density will lead to 1.372% increase in economic growth in Ghana. The result coincides with the study's expectation which stated that population density has a positive relationship with economic growth. The empirical result can be explained that, in Ghana cities like Accra, Tema, Kumasi and Takoradi and so on are densely populated. These cities provide large and concentrated market, allowing for economies of scale in the production of manufactured goods at a relatively low transportation cost. It is in these urban areas that firms can better match their labour demands with the supply of skills, while the return to infrastructure such as roads, port facilities and electricity grids are greater due to the concentration of industries and firms. With the easy access to factors of production at a relatively cheaper cost, production of goods and services can conveniently take place. The empirical result is consistent with Hamza (2008) who also reported a positive link between population density and economic growth.

Variable such as the log of the unemployment rate (UR) was not statistically significant. This implies that these variables have no effect on economic growth of Ghana in the short-run.

5.4.1 Result from Diagnostic Testing

Heteroscedasticity testing

The Breusch –Pagan test of heteroscedasticity adopted by Koenker (1981), Honda (1985), Zeilies and Hothorn (2002) were employed to ascertain whether the error term is constant across observation (Homoscedastic) or not. The null hypothesis of the heteroscedasticity states that there is no heteroscedasticity in the model whiles the alternative states that there is heteroscedasticity. The decision rule is that if the F-calculated is greater than the F-critical, reject the null hypothesis or if the p-value is greater than 5% (0.05) significant level. From the result as presented in Table 5.7 it can be ascertained that heteroscedasticity bias was absent in the model. This is due to the fact that the probability value of the F-statistic (0.4388) was not statistically significant at any level (that is at 1%, 5% and 10% significance levels).

Normality Testing

The test is conducted to check whether the error term follows a normal distribution. The normality test adopted is the Jarque-Bera (JB),(2011) statistic which follows chi-square distribution with 2 degrees of freedom. The hypothesis to test is:

$H_o : \mu_i = 0$ (Residual term is normally distributed)

$H_1 : \mu_i \neq 0$ (Residual term is not normally distributed)

The null hypothesis states that residual term is normally distributed whiles the alternative also states that the residual is not normally distributed. The decision rule is also that if the Jarque-Bera statistic is greater than the critical value reject the null hypothesis or if the p-value is less than 5% (0.05) significant level.

Decision Rule: Reject the null hypothesis (H_0) if JB calculated is greater than JB critical, accept otherwise. Application of the JB test shows that JB calculated equals = 2.4138 and the probability of obtaining such statistic under the normality assumption is about 29.9% and since the probability is greater than the 5% (0.05) significant level the null hypothesis cannot be rejected and conclude that the residual term is normally distributed. The result is presented in Table 5.7. Also looking at the histogram at Figure (5.1) we observed that the residual is normally distributed.

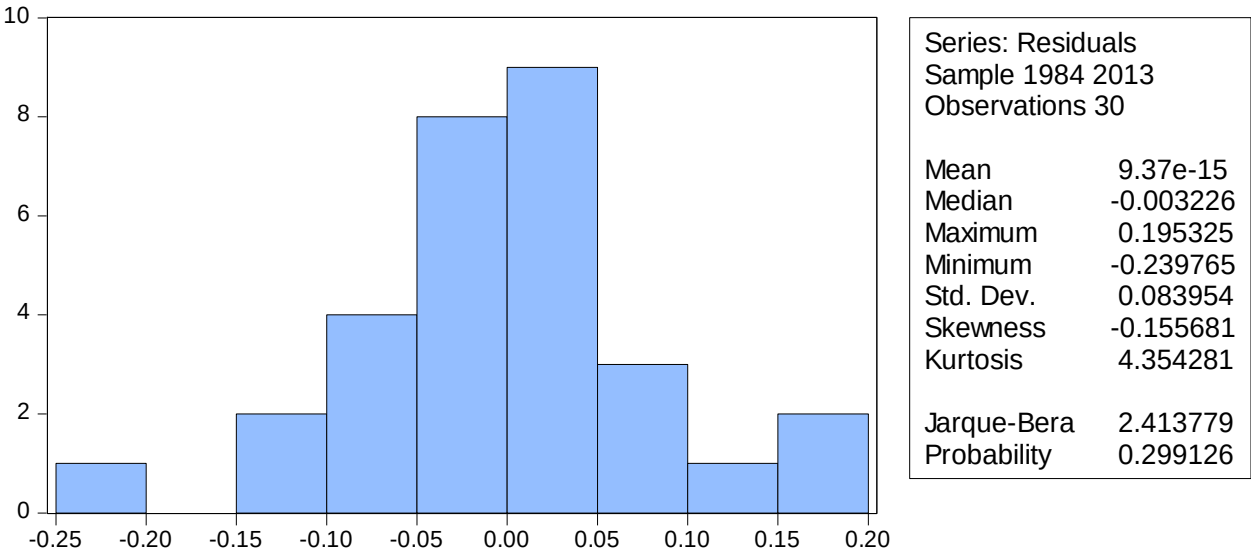

Figure 5.1: Histogram confirming the normality assumption

Serial correlation Testing

This was carried out in this study using Durbin Watson (1951) f-statistic. The hypothesis to be tested is stated as;

$H_O : \lambda_i = 0$ (No serial correlation)

$H_A : \lambda_i \neq 0$ (Serial correlation exist)

Decision Rule: If computed λ is less than dl, there is evidence of positive first order serial correlation; if it is greater than du, there is no evidence of positive first order serial correlation, but if the d-calculated is lies between the lower and the upper limit, there inconclusive evidence regarding the presence of positive first order serial correlation. The summary of the decision rule is presented in Table 5.7

Table 5.7: Durbin Watson (1951) Test: Decision Rule

Null Hypothesis	Decision	If
No positive serial correlation	Reject	$0 < d < d_1$
No positive serial correlation	No decision	$D_L \leq d \leq d_U$
No negative serial correlation	Reject	$4 - D_L < D < 4$
No negative serial correlation	No decision	$4 - D_U \leq D \leq 4 - D_L$
No Serial correlation, positive or negative	Do not reject	$D_u < d < 4 - D_u$

From table 5.7 it can be observed that Durbin-Watson statistic d = 10.4256, also the probability value of d_l and d_u is 11.36% which is greater 5% (0.05). From the result above we do not reject the null hypothesis of no serial correlation positive or negative and conclude that there is no evidence of positive or negative first-order serial correlation.

Table 5.8: Results of the diagnostic testing Error correction for ARDL

Variable	F-Statistic	P-Value
Normality (Jarque-Bera)	2.4138	0.2991
Heteroscedasticity	0.6136	0.4388
Serial Correlation	10.4256	0.1136

Stability test

For the parameter stability testing, the study employed the AR root test for stability and Cumulative Sum (CUSUM) test as used by Pesaran and Pesaran (1997). The stability test through the use of the Cumulative Sum (CUSUM)was tested at 5 percent significant level; the result is presented in figure 5.3. The result for the AR root test for stability as adopted by Elliott et al (1992) is conducted and the result presented in Table 5.9 and Figure 5.2. The empirical

result of the AR root test for stability indicates that all the variables included in the model were stationary (stable).

Table 5.9: AR Root test for stability

Root	Modulus
0.872079 - 0.313226i	0.926624
0.872079 + 0.313226i	0.926624
0.739918 - 0.525422i	0.907495
0.739918 + 0.525422i	0.907495
0.879398	0.879398
-0.165549 - 0.650075i	0.670823
-0.165549 + 0.650075i	0.670823
-0.595992 - 0.156980i	0.616319
-0.595992 + 0.156980i	0.616319
-0.022578 - 0.550828i	0.551291
-0.022578 + 0.550828i	0.551291
0.385383 - 0.098383i	0.397742
0.385383 + 0.098383i	0.397742
-0.095043	0.095043

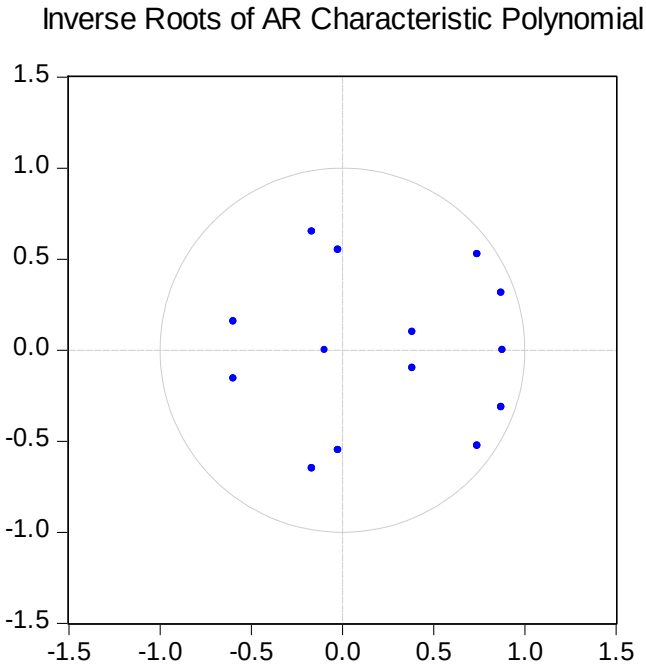

Figure 5.2: AR root test for stability

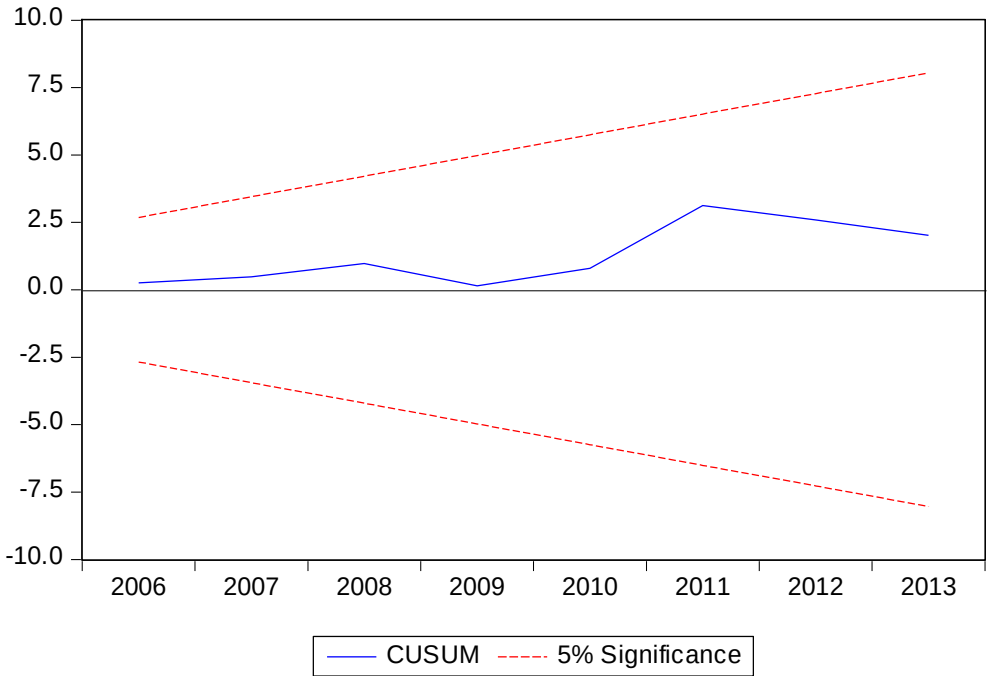

Figure 5.3: Plot of Cumulative Sum of Squares of Recursive Residuals

Multicolinearity Test

The pairwise correlation matrix and the variance inflation factor were employed to test whether there is the presence of Multicolinearity among the explanatory variables. The result is presented in the Appendix 1. The results indicate none of the variables were highly correlated.

5.4.3 Granger Causality

To test whether population growth causes economic growth (Unidirectional causality) or economic growth causes population growth or population growth and economic growth cause each other (bi-directional causality) the pairwise granger causality approach was employed. The study applies the F-test given by the equation (5).

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/n-k} \qquad (5)$$

This follows the F-distribution with m and (n-k) degree of freedom. The null hypothesis in each case is that the variable under consideration does not cause the other variable.

Decision Rule: Reject the null hypothesis if the computed F-value is greater than the critical F-value at 1%, 5%, and 10% significant levels. The result was obtained as displayed in the Table 5.10. The result suggests that there is unidirectional causality between population growth and economic growth. This implies that population granger causes economic growth at lag 2. More so, mutual independence is population growth and economic growth. This result agrees with (Nwosu *et al.*, 2014) which assessed the effects of population growth on economic growth in Nigeria

Table 5.10: Pairwise Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.	Comment
LLF does not Granger Cause LGDPG	32	0.59973	0.5561	Null not rejected
LGDPG does not Granger Cause LLF		0.89174	0.4217	Null not rejected
LPOPD does not Granger Cause LGDPG	32	3.63907	0.0399	Null rejected
LGDPG does not Granger Cause LPOPD		7.36861	0.0028	Null rejected
LPOPG does not Granger Cause LGDPG	32	2.93121	0.0705	Null rejected
LGDPG does not Granger Cause LPOPG		1.23745	0.3061	Null not rejected
LUR does not Granger Cause LGDPG	32	0.43582	0.6512	Null not rejected
LGDPG does not Granger Cause LUR		3.11080	0.0608	Null rejected
LGKF does not Granger Cause LGDPG	32	4.64930	0.0184	Null rejected
LGDPG does not Granger Cause LGKF		10.6309	0.0004	Null rejected

Source: Author's Computation (2015)

It can be inferred from Table 5.10 that there exist bi-directional causality between log of population density (LPOPD) and log of gross capital formation (LGKF) with economic growth. However, there exist uni-directional causality between log of population growth (LPOPG) and log of unemployment rate (LUR) with economic growth. However, LLF does not granger cause economic growth over the period of study.

Evaluation of Working Hypothesis

The study hypothesis includes:

H_0 : Population growth has no significant effect on economic growth of Ghana.

These hypotheses can be evaluated from the results of our models. From the t-test that was carried out on the explanatory variable, the study found population growth to be statistically significant. This implies that population growth scientifically impact on economic growth.

From the Table 5.9, the study shows that there is unidirectional causality between population growth and economic growth. This means that population growth significantly causes economic growth.

From the Table 5.3 result, the cointegration test carried out shows that there is sustainable long-run relationship or steady-state path between economic growth and population growth, since F-calculated was greater than F-critical from the Pesaran Table whether at 1%, 5% or 10%. The study therefore draws the following conclusions based on the findings above;

- For the first hypothesis, the study rejected the null hypothesis that population growth has no significant effect on economic growth and accept the alternative hypothesis.

CHAPTER SIX

SUMMARY, CONCLUSION, AND RECOMMENDATION

6.0 Introduction

This section presents the summary of the study, conclusion and policy recommendation.

6.1 Summary

Establishing relationship between population growth and economic growth has therefore been fundamental to the policy makers in different countries. However, there has been no agreement whether population growth is beneficial or detrimental to the economic growth in the developing countries. Given this scenario, there was thus a need to establish the relationship between population growth and economic growth in Ghana. Past studies such as Afzal (2009) revealed that population growth negatively affects economic growth. Nonetheless, other studies (for instance Kuznets, 1967; Kelley ,1988; Kelley and McGreevy ,1994; Thuku et al., 2013) also revealed that population growth have positive effect on economic growth in long run due to increase in productivity as a result of learning-by-doing by means of increase in production volume, and sharing of new ideas.

This study therefore primarily attempts to investigate the empirical relationship between population growth and economic growth in Ghana by applying the ARDL bounds testing model to examine both the long and short run on the variables of interest. Specifically, the study seeks to determine the causality between population growth and economic growth and the relationship between them. Hence, economic growth is assumed to be the promoting element in the development process in Ghana. It also finds the extent to which population density, labour force, gross capital formation, and unemployment rate affect economic growth

The study applies Philip-Peron (PP) and Augmented Dickey –Fuller(ADF) unit root tests to ensure all the variables are integrated of order I[0] or [1]. To ensure that long run and short run dynamics exist in the variable of interest, we confirm using the variable addition test in which the F-statistics exceeds the Pesaran et al., (2001) calculated value. This show the existence of long and short run dynamics exist. The study finds out that all the models pass the diagnostic test by ensuring the model pass all the problems associated with ARDL model in time series such as serial correlation, functional form, normality and heteroskedasticity. The model also passes the stability test by ensuring that the cumulative sum of recursive residuals (CUSUM) is significant at 5% level as well as the AR root test. Hence, the results are robust to the estimation techniques. Granger causality is applied in order to test the causal flow between population growth and economic growth and vice versa. The Durbin-Watson test to serial correlation, Breusch- Pagan test to heteroscedasticity and the Jarque-Bera test to normality were employed to test the reliability of the goodness of fit of the model.

The study reveals that at lag 2, the causality between population growth and economic growth is not contemporaneous, as population growth granger cause economic growth. The study also found out that the effect of population growth on economic growth is negative and statistically significant for both long and short run.

This implies that population growth alone cannot cause a reduction in the economic growth but it is mostly enhanced by the help of other exogenous factors.

6.2 Conclusions

The empirical result revealed that in the short run gross capital formation had a positive significant effect on economic growth with a coefficient of 0.464 but statistically non-significant

in the long- run. In the long-run, unemployment rate had a negative statistically significant effect on economic growth with a coefficient of -0.728 whereas population density and labour force had a positive statistically significant effect on economic growth with coefficients of 1.642 and 1.730 respectively.

6.3 Recommendation

Based on the study's results, the following policy guidelines are recommended;

With the results indicating a negative relationship between population and economic growth, a carefully planned population growth strategy coupled with institutional and policy changes could be beneficial to this country. A well-managed population expansion will ensure that both the population and the economy are complementing each other without concerns that population expansion will lead to high rate of unemployment coupled with low standard of living and lack of other socio economic facilities in Ghana.

Therefore, the study recommends that for population growth to impact positively on economic growth; government should gear it policies towards family planning policies and the establishment of job where the huge labour force can be absorbed.

The government should also put measures to ensure that the economy grows at a higher rate than the population growth. This will ensure that the increasing demand of services arising from the population growth is met. Having a larger, healthier, and better-educated workforce will only bear economic fruit if the extra workers can find jobs. Open economies, flexible labour forces,

and modern institutions that can gain the confidence of the population and markets alike may help countries reap the potential benefit created by their demographic

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Appendix

Pairwise Correlation Matrix result

	LnGDPg	LnGKF	LnLF	LnPOPD	LnPOPG
LnGDPg	1.000				
LnGKF	0.373	1.000			
LnLF	-0.236	0.392	1.000		
LnPOPD	0.567	-0.359	-0.501	1.000	
LnPOPG	-0.490	0.178	0.587	-0.412	1.000

Variance Inflation Factor (VIF)

VARIABLE	VIF	I/VIF
LnPOPD	6.77	0.148
LnLF	9.41	0.106
LnPOPG	4.81	0.208
LnGKF	1.21	0.826
MEAN VIF	5.55	

Results of the ARDL

Autoregressive Distributed Lag Estimates
ARDL(1,1,1,0,0,1) selected based on Akaike Information Criterion

Dependent variable is LGDPG
33 observations used for estimation from 1981 to 2013

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LGDPG(-1)	.16450	.12114	1.3579[.187]
LGKFI	.46438	.051742	8.9749[.000]
LGKFI(-1)	.14414	.076055	1.8952[.070]
LLF	6.6744	4.8880	1.3655[.185]
LLF(-1)	-8.1201	4.9205	-1.6503[.112]
LPOPD	1.3719	.24338	5.6368[.000]
LUR	.020191	.055137	.36619[.717]
LPOPG	-3.5036	.90829	-3.8574[.001]
LPOPG(-1)	4.0008	.68275	5.8599[.000]

R-Squared	.92381	R-Bar-Squared	.89841
S.E. of Regression	.17613	F-stat. F(8, 24)	36.3756[.000]
Mean of Dependent Variable	2.4436	S.D. of Dependent Variable	.55262
Residual Sum of Squares	.74455	Equation Log-likelihood	15.7344
Akaike Info. Criterion	6.7344	Schwarz Bayesian Criterion	.1471E-3
DW-statistic	2.1283	Durbin's h-statistic	-.51311[.608]

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .33839[.561]	F(1, 23)= .23829[.630]
B:Functional Form	CHSQ(1)= 13.1021[.143]	F(1, 23)= 15.1447[.223]
C:Normality	CHSQ(2)= .83604[.658]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 1.9504[.163]	F(1, 31)= 1.9473[.173]

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,1,1,0,0,1) selected based on Akaike Information Criterion

Dependent variable is LGDPG
33 observations used for estimation from 1981 to 2013

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LGKFI	.024166	.066017	0.36606[.718]
LLF	1.7304	.47291	3.6591[.001]
LPOPD	1.6420	.29895	5.4926[.000]
LUR	-.72832	.10129	-.7.1902[.000]
LPOPG	-.34495	.0.88055	-3.9175[.001]

```
         Error Correction Representation for the Selected ARDL Model
       ARDL(1,1,1,0,0,1) selected based on Akaike Information Criterion
********************************************************************************
 Dependent variable is dLGDPG
 33 observations used for estimation from 1981 to 2013
********************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 dLGKFI                     .46438            .051742             8.9749[.000]
 dLLF                      1.7340             .46528              3.7269[.001]
 dLPOPD                    1.3719             .24338              5.6368[.000]
 dLUR                     -.020191            .055137            -.36619[.717]
 dLPOPG                   -3.5036             .90829             -3.8574[.001]
 ecm(-1)                  -.83550             .12114             -6.8968[.000]
********************************************************************************
 List of additional temporary variables created:
 dLGDPG = LGDPG-LGDPG(-1)
 dLGKFI = LGKFI-LGKFI(-1)
 dLLF = LLF-LLF(-1)
 dLPOPD = LPOPD-LPOPD(-1)
 dLUR = LUR-LUR(-1)
 dLPOPG = LPOPG-LPOPG(-1)
 ecm = LGDPG   -.0.024166*LGKFI -   1.7304*LLF   -1.6420*LPOPD  +.72832*LUR   +.
3.4495*LPOPG
********************************************************************************
 R-Squared                      .89714   R-Bar-Squared                    .86285
 S.E. of Regression             .17613   F-stat.    F(  5,  27)   41.8656[.000]
 Mean of Dependent Variable    .017699   S.D. of Dependent Variable      .47561
 Residual Sum of Squares        .74455   Equation Log-likelihood        15.7344
 Akaike Info. Criterion         6.7344   Schwarz Bayesian Criterion    .1471E-3
 DW-statistic                   2.1283
********************************************************************************
 R-Squared and R-Bar-Squared measures refer to the dependent variable
 dLGDPG and in cases where the error correction model is highly
 restricted, these measures could become negative.


LONG RUN COINTEGRATION RESULTS
```

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	10.48060	(4, 27)	0.0000
Chi-square	41.92239	4	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2) - C(6)	-0.599596	0.346197
C(3) - C(6)	-0.142425	5.581375
C(4) - C(6)	2.649212	0.457782
C(5) - C(6)	0.338949	0.894643

Restrictions are linear in coefficients.