DUTSE JOURNAL OF ECONOMICS AND DEVELOPMENT STUDIES (DUJEDS)
DEPARTMENT OF ECONOMICS AND DEVELOPMENT STUDIES
FEDERAL UNIVERSITY DUTSE
E-Mail: dujeds@fud.edu.ng

AGE STRUCTURES AND ECONOMIC GROWTH OF AFRICAN COUNTRIES: AN EMPIRICAL ANALYSIS

HASSAN, Ibrahim Bakari
Department of Economics, School of Management and Information Technology, Modibbo Adama University of Technology, Yola - Nigeria

ANIEKAN, Akpansung O.
Department of Economics, School of Management and Information Technology, Modibbo Adama University of Technology, Yola - Nigeria

AMADE, Peter
Department of Economics, Faculty of Social and Management Sciences, Adamawa State University, Mubi - Nigeria

Abstract
The age composition of a population is important for several reasons. The proportions of children and older persons have much to do with the balance of national expenditures on schools, childcare, immunization and reproductive health, as against expenditures on old-age social security systems and health care for chronic and degenerative diseases. This study examines the impact of age structures on the economic growth of fifty Three (53) African countries between 1980 and 2019. The objective of the study was to determine the impact of the young population (0 -14 years), working (15 -64 years) and the aging population (65+) years, using panel data sourced from the World Development Indicators database of the World Bank, 2019. The study used the dynamic panel estimation techniques of difference and system Generalized Method of Moments (GMM). The results based on the system GMM estimation techniques revealed that the young population and prevalence of HIV/AIDS on the working class have negative and significant impacts on economic growth. The working population, aging populations, life expectancy and fertility rates have positive impact on economic growth of African countries. The study recommends among others that the governments of the African countries should put appropriate policies in place to invest in the health and well-being of their population, through better health care delivery service systems, so as to increase life expectancies and reap significant economic growth rates.

Keywords: Demographic Change, Fertility, Economic Growth, Africa and Panel Data.
JEL Classification: J11 J13 O40 O55 C23

Introduction

The phenomenal increase of East Asia's real per-capita income during the past four decades is one of the economic miracles of the century. This is because no region or sub-region has ever witnessed such a rapid increase in economic growth. While this growth is attributed to export-oriented policies, investment in health, education, high savings rate and capital accumulation, demographic changes cannot be undermined. This is because the region stands out because of its demographic profile among other regions of the world (Bloom, Canning &Melaney 1999; Song, 2013). The processes and consequences of demographic changes such as

demographic transition, age structure transition, and increase in life expectancies, urbanization and ageing of the population are principal components in the analysis of the impact of demographic change and economic growth. There is no doubt that demographic change can have severe impact on poverty, economic growth, health, fragility, economic growth and human development, and therefore it is very important. However, the nature of the impact of demographic change is not clear-cut and thus there are divergent views and evidences on the subject matter. However, the East Asian experience has prompted several studies in an attempt to replicate the success recorded in East Asia in other regions of the world, especially Sub-Sahara Africa (Canning, Raja &Yazbeck, 2015).

The age composition of a population is important for several reasons. The proportions of children and older persons have much to do with the balance of national expenditures on schools, childcare, immunization and reproductive health, as against expenditures on old-age social security systems and health care for chronic and degenerative diseases. The ratio of the population aged 65 and above to the working-age population is a fundamental consideration in the design of public pension arrangements, and the ratio has its micro level expression in the age structure of the family, affecting the possibilities for private care of children and older persons. Political clout may also be linked to relative population proportions (Preston, 1984) as reported in United Nations Department of Economic and Social Affairs (UNDESA, 2004). Moreover, age structure alters the way in which the forces of fertility and mortality are expressed in rates of population growth.

Age structural transition- a process and consequence of shifting age structure from a young aged population to old aged population- is an integral part of a demographic transition whose trajectories are determined by the timing and speed of fertility and mortality declines. Fertility and mortality are constant during the early stages of a demographic transition resulting in a constant age structure. However, when mortality declines and fertility is constant in the later stages of a demographic transition, a large share of a country's population is young, leading to a high dependency ratio. Later, when fertility also starts declining, the cohorts of the high fertility regime in the previous stage of demographic transition move into the working ages contributing to a decline in the dependency ratio. During the final stage of the demographic transition, when both fertility and mortality reach the lowest level, the share of old aged population increases as cohorts of the high fertility regime age and are followed by a stable age distribution. Thus, as noted by Navaneetham (2002). The dependency ratio increases during the final stage of demographic transition due to an increase in the elderly population.

Demographic change accounts for as much as a third to a half of the mystery surrounding the sustained high rates of income growth that came to be known as the East Asian miracle. During the 1960s through to the 90s, the working –age population of the region grew nearly ten times faster than the dependency ratio of the population. Age structure is certainly not the only factor that has influence on economic growth, but it certainly emerges as one of the most potent influences. The demographic transition, involves declines in fertility as well as mortality rates is a precursor to the demographic change phenomenon, which is also a precursor to the changes in age structures which spur economic growth rates as we have seen in East Asia (Bloom, Canning & Malaney, 1999).
While all regions would have strived to achieve the same economic miracle as was achieved by the East Asian economies, it is clear that demographic transition in all sub-regions are not at the same pace, thus, age structural transitions would equally be uneven. Africa and indeed the Sub-Sahara African region have the highest rate of population growth estimated to be 2.55%. Similarly, demographic transitions in this region is very slow and in some cases, stalled. Africa is the youngest population in the world, where a greater proportion of the population are young, and life expectancies are lowest compared to other regions of the world. This makes Africa, very unique in socio-economic and demographic features. Several studies have been conducted on demographic change and economic growth. However, most of these studies were conducted in Asia, relatively fewer in Sub-Sahara Africa and other regions. Such studies include; Bloom, Canning, Fink & Finlay (2007), Bloom et al.,(1999), Bloom, Humair, Rosenborg, Sevilla and Trussell (2013), Eastwood and Lipton (2011), Emelyanova (2015), Harrysong (2014), Hyung (2013), Maestas, Mullen and Powell (2014), Nagarajan, Teixeira, and Silva (2016), Navaneetham (2002), Song (2013), Sundman (2011), Hence, there is a need to explore the impact of the unique demographic features of West Africa countries in relation to the economic growth potentials of the region.

Thus the objective of the study is to determine the impact of demographic changes (age structures) on economic growth of African countries between 1980 and 2019. Specifically, the study will determine the impact of the young population (0 - 14 years), the working population (15 - 64 years) and the aging population 65+ years. The paper is divided into five sections, section one is the

background to the paper, section reviewed of related works in the area, section three method of empirical analysis and finally, section five is conclusion and policy implication.

Literature Review

Demography is the study of populations, aimed at establishing their numbers, their composition by age, sex and marital status, and their future evolution (ECOWAS-SWAC/OECD, 2007). Demographic changes are the dynamics in measureable terms, or statistics of a given population. Demography studies population changes by investigating such demographic variables such as gender, age/ age structures, ethnicity, home ownership, mobility, disabilities, language knowledge, employment status and location. These elements and how they change constitute vital information about the population of a given location and its culture. Demography examines the relationship between the population and changes through deaths, births and migration in demographic composition, with the natural environment and with social and economic change (Song, 2013). Demographic indicators may include population size, crude birth rate, population growth rate, crude death rate, fertility rate, life expectancy and infant mortality. Estimated and projected gender and age distributions in relation to fertility rates could also be included. The impact of demographic change is considered as one of the most important challenges as well as the most important determinants of growth for the future of both developed and developing economies.

Demographic changes influence all aspects of human activity, including economic, social, political and cultural. For instance, the age distribution of a population has an overwhelming influence on health-care needs. An aging population is more likely to put considerable pressure on public spending programs, such as health-care and pension plans. Similarly, a young population will demand huge investment in education for a potentially high economic outcome in the working stage of the young population (Song, 2013).

Age structures and Economic Growth

The demographic transition is a change from a situation of high fertility and high mortality to one of low fertility and low mortality. High rates of population growth result in decline in mortality rates, which precedes a further decline in fertility rates. Less widely recognized, though perhaps more important, it also suggests sizable changes in the age distribution of the population (Bloom, Canning &Malaney, 1999). The demographic window is the period in which the working-age population is growing and the young cohort decreasing, as well as a relatively small size of the old cohorts (Ven& Smits, 2011).

Evidence suggests that fertility rates fall with an increase in income, thereby lowering the dependency ratio and perhaps allowing an increase in labor force participation rates. However, it is observable that in some cases the demographic change may be as a result of economic growth rather than its cause (Bloom, Canning &Malaney, 2010). Similarly, economic success may have important consequences for demography. Health and life expectancy may rise with income as people gain greater food security and access to health care, both publicly and privately.

Changes in the age structure of the population creates the potential for faster economic growth, a phenomenon referred to as the demographic dividend. The changing age structure has implications for the future. Changes in the size, age structure and location of the population have direct implications for the level and distribution of economic resources. This is because population constitutes the human capital and its potential labour supply. From a purely economic viewpoint, the working population is a factor of production and its aptitude and skill level determines productivity level of the national economy (Agwanda & Amani, 2014). Bloom Canning & Rosenborg (2011) opined that there are some basic features of the demographic transition. First, is the swelling of the labour force, as the babies reach the working age. The second is the diversion of resources from spending on children to investing in physical capital, job training, and technological progress. Third, is the rise in women's workforce activity that naturally accompanies a decline in fertility.

Bloom, *et al*., (2013) suggest that the age structure of the population determines several economic variables such as savings, investment and productivity, which in turn determines economic growth. Similarly, the age structure is determined by demographic transition, that is, a reflection of fertility declines from high fertility to low fertility. For instance, the East Asian countries have a different pattern of age structure from the African countries. Their fertility rate declined rapidly, from high fertility and high ratio of children to working class. Conversely, Africa's fertility rates have declined and are declining slowly or stalled in some cases, thus keeping fertility rates still high, and maintaining a high ratio of children to the working class, keeping dependency ratio high, affecting savings, investment and productivity negatively and consequently economic growth. Presently, East Asia's income per-capita is almost triple that of Africa (Bloom *et al.,* 2013). East Asia

alongside other some other regions of world have recorded tremendous economic benefits due to the changes in the age structure which started in the 1980s. By now, the pattern of population of the region has changed to an aging one.

By 2016, Asia, Latin America and the Caribbean had the highest ratio of their population in the working class with 68%, while Europe lost a certain percentage to aging with 66% in the working class. The remarkable advancement is associated with the Asian economies recently is usually associated with the reduction in the young population and the swelling in the working class of the population, a cause and consequence of demographic transition. Surprisingly, Africa has remained largely unchanged in its structure; there are only insignificant changes in its structure. The proportion of children changed from 41.5% to 41%, the working class changed from 55.1% to 56% and the aged changed from 3.4% to 3%. This suggests that in a decade, the adjustment in the age structure of African population is merely in decimal figures, less than 1 within age groups (UNDESA, 2004; UNDP 2018).

Table 1: Age Distribution Across Major Regions of the World

	Population in thousands (000) 2005			Percentage (%) 2005		
Region	**0 – 14**	**15 -64**	**65+**	**0 - 14**	**15 -64**	**65+**
World	1,821,044	4,167,986	475,719	28.2	64.5	7.4
Africa	375,578	499,590	30,767	41.5	55.1	3.4
Asia	1,085,986	2, 568,786	250,644	27.8	65.8	6.4
Europe	115,473	497,154	115,762	15.9	68.3	15.9
Latin America and Caribbean	168,147	358,934	34,265	30.0	63.9	6.1
North America	67,653	221,993	40,961	20.5	67.1	12.4
Oceania	8,207	21,529	3,319	24.8	65.1	10.0
	2016					
World	1,984, 533	4,961,332	686,953	26	65	9
Africa	528,047	721,235	38,637	41	56	3
Asia	1,090,831	3,090,690	363,610	24	68	8
Europe	118,823	490,147	133,676	16	66	18
Latin America And Caribbean	169,523	430,327	52,160	26	68	8
North America	69,130	240,137	54,576	19	66	15
Oceania	9,490	26,819	4,951	23	65	12
	2050					
World	1,832,572	5,778,393	1,464,938	20.2	63.7	16.1
Africa	555,663	1,252,474	128,815	28.7	64.7	6.7
Asia	953,891	3,352,796	910,515	18.3	64.3	17.5
Europe	98,111	375,078	180,134	15.0	57.4	27.6
Latin America and Caribbean	141,403	497, 783	143,717	18.1	63.6	18.4
North America	74,951	270,437	92,563	17.1	61.8	21.1
Oceania	8,554	29,825	9,194	18.0	62.7	19.3

Source: UNDESA/population division, 2004; UNPD, 2018.

The projections of 2050 as presented in table 1.1 suggests that Africa can only obtain an age distribution similar to what other regions had in 2016 only in 2050. Projections suggest that by 2050, Africa will have the largest proportion of working class, 64.7, larger than the global average of 63.7, and young proportion would be 28.7, greater than the global average of 20.2 for the young age group. Perhaps it can be said Africa is far from achieving the Asian type of economic growth trends of recent times except the speed of adjustment within its age distribution increase significantly (UNDP, 2018)

The Young Population and Economic Growth Relationship

African countries have young population because of the trend of high fertility in Africa. A reduction in fertility can change a country's age structure and can positively affect economic growth. When the ratio of the working class relative to children and the aged (elderly) is higher, then, the working class will have less dependents to support, and thus there will be more improvement in overall welfare leading to economic growth. However, Sub-Sahara African region was the youngest sub-region in the world with about 44% of its population under 15 years in 2007. Comparatively, Europe has only 16% of its population under 15 years, Latin America, Caribbean and Asia have about 30% of their populations under 15 (Ashford, 2009).

Globally, the proportion of young people (the under-15s) is projected to decline from 28% to about 20% between 2005 and 2050. Similarly, the proportion of the aging population, over-60s is also projected to increase from 10% to around 22%. By 2050, the proportion of young people could still be about 29% in sub-Saharan Africa, 28% in West Africa but only 15% in Europe. In sub-Saharan Africa, West, Central and East Africa are experiencing a fall in the median age, which is

considerably increasing the dependency ratio, unlike Southern and North Africa, where the median age is increasing (ECOWAS_SWAC/OECD, 2007).

The young population is associated with a detrimental effect to economic growth. It is an age grade that contributes so little to economic growth accumulation, while demanding so much in the form of resources for education, and health (Song, 2013). Youth can be a positive force for development when provided with the knowledge and opportunities they need to thrive. In particular, young people should acquire the education and skills needed to contribute in a productive economy, and they need access to a job market that can absorb them into its labour force. Among the greatest challenges facing many countries today are inadequate human capital investment and high unemployment rates among youth (UNPD, 2015).

The Working-Population and Economic Growth Relationship

The working age population is defined as those aged 15 to 64. The basic indicator for employment is the proportion of the working age population aged 15-64 who are employed. The age dependency ratio is the ratio of dependents (people younger than 15 or older than 64) to the working-age population. This indicator is measured as a percentage of population (OECD, 2018).

The relationship between the active working population and economic growth holds more consensus than the relationship between other structures of the population and economic growth. This position was first reported by Bloom, David and Williamson (1998). It was later confirmed by several subsequent studies such as Song (2013), Bloom, Canning and Sevilla (2001), Bloom, Canning and Malaney (1999). It is established that population growth rate has mixed impact on economic growth, but when the growth ratio of the working population is considered, it is confirmed to have a positive impact on growth. The economic miracle of the Asian giants is closely associated with the advanced stage of the demographic transition which entails the swelling of the working class population.

Navaneetham (2002) purports that the age share of the population 50-64 is the most positively associated with the economic growth in some Asian countries- Singapore, Malaysia and Thailand. Similar findings were also observed in other studies of OECD and Scandinavian countries as reported by (Lindh & Malmberg, 1999; Andersson, 2001). It is expected that this population is more experienced and likely to earn more than the prime working age population. Also, the people in this age group are likely to save more since consumption on bearing and raising their children would have been largely completed. The increase in the saving rates is likely to contribute to higher economic growth in the country.

The Ageing Population and Economic Growth Relationship

Population ageing—the increasing share of older persons in the population—is poised to become one of the most significant socio-demographic transformation of the twenty-first century. Population aging has implications for nearly all sectors of society, including labour and financial markets, the demand for goods and services, such as housing, transportation and social protection, as well as family structures and inter-generational ties (UNPD, 2015).

The number of persons aged 60 years and above in the world was estimated to be 605 million in 2000. This figure is however projected to reach nearly 2 billion in 2050, at which time it will be as large as the young population of the world (0-14 years). The oldest of the old, who are aged 80 years and older are about 70 million, majority of who live in developed countries (Mirkin & Weinberger, 2014). The high incidence of aging population is a characteristic of the European populations. Generally speaking, it is not entirely theoretically or empirically right to conclude that the share of population aged 65 and above has a positive or negative impact on economic growth of Per capita economic growth. Song (2013) confirmed that the proportion of the aged population may have positive or negative impact on economic growth, when he studied some Asian countries' age structure and economic growth.

An aging population has implications for consumption and saving patterns, public expenditure and human capital. It is argued that the overall demand for certain goods will be affected. Some commodities which are basically demanded by younger population will be low on demand. For instance, the demand for education will fall in countries that have a large proportion of aging population. This is because much of the consumption of preferences of the aged are medical care. It will affect public expenditure in the sense that the government will increase its spending on medical systems and social security for supporting the aging population. There will also be an effect in the sources of internal revenue generation of the economy, since it is the working population that pays tax. The process of transition from the working population to the ageing population will reduce potential tax income. With the shrinking of the working population, there will be a fall in productivity. Similarly, it will affect foreign direct

Investment as investors will not like to invest in a country with an aging population, therefore affecting overall economic growth through these mechanisms (Nagarajan, Teixeira & Silva, 2013). Rapid population aging in Russia and Eastern European countries will result in a range of problems such as growing pressures on countries' pension system, higher demand for health care, increasing tax burden on an already shrinking working-age population (Gavrilona & Gavrilov, 2009).

Empirical Review

A good number of studies have been conducted on the impact of demographic changes on economic growth since the phenomenal increase in economic growth recorded by the countries of East Asia. The East Asian experience thus became the motivation of conducting studies in other regions to examine the relationship between demographic changes and economic growth of countries. Notable among these studies are Bloom, Canning, Fink and Finlay (2007), Bloom Canning and Malaney (1999), Bloom, Humair, Rosenborg, Sevilla and Trussell (2013), Eastwood and Lipton (2011), Emelyanova (2015), Feng (2005), Harrysong (2014), Hyung (2013), Kunin (2009), Maestas, Mullen and Powell (2014), Nagarajan, Teixeira, and Silva (2016), Navaneetham (2002), Song (2013), Sundman, (2011), Thuku, Paul and Almadi (2013) among others.

Song (2013) carried out a cross country analysis of thirteen (13) Asian countries between 1965 and 2009, to determine empirical evidence of the relationship between demographic changes and economic growth. The study used the panel data analysis technique of Pooled Ordinary Least Squares (OLS). Bloom, Humair, Rosenborg, Sevilla and Trussell (2013), studied demographic change and economic growth in South Asia. The study was conducted descriptively, and thus there are empirical conclusions that can be substantiated with analytical results in their study. Similarly, Feng (2005) also conducted a descriptive analysis studying demographic dividends and prospect for development in China. The study conducted a comparative descriptive analysis using charts and bars among the selected countries of South Asia. The studies conducted descriptively can at best depict graphically or using tabular presentations, the trend and patterns of the demographic changes vis-à-vis economic growth. However, they cannot provide any empirical evidence as to the magnitude and significance or otherwise of the impact of the demographic changes on economic growth.

Bloom, Canning &Malaney (1999) equally conducted a study on demographic change and economic growth in 70 Asian and non-Asian countries using panel data analysis techniques - Pooled OLS, Random and Fixed effects models between 1965 and 1990. The study was conducted empirically using a model that included regressors like the proportion of the working population and the total population, labour force participation, fertility and dependency ratio. The study introduced instrumental variables to correct for reverse causation between growth rates of the working population and the total population. But the study did not include the aging population as well as the young population ratios to examine their relative impacts on growth rate. On the contrary, Song (2013); Ven& Smits (2011) in a similar study modeled variables such as the growth rates of the young population and the working population in their model. At the same time, the panel analysis was conducted for five consecutive five-year periods between 1965 -1990. Song (2013) also adopted the five-year period of analysis in his study, where he has 9 five-year periods between 1965 and 2009. This explained the dynamics of demography within the five year periods, however, a longer period of analysis would have been more significant in showing the shifts from one age structure to the other. In fact the shift from working-class to aging-class takes almost 40 years, thus, some salient features of the demographic changes may have been silent owing to the five-year analysis period. However, the study falls short in time scope by almost twenty years compared to the study of Song (2013).On the other hand, Bloom, Canning, Fink and Finlay (2007) used a cross section of about 67 countries to test whether age structure forecast economic growth. The data were collected from the Penn World tables over the period 1960 to 2005 and projections were made for 2005 -2050. The regression analysis sought to identify the relationship between age structure and economic growth in Asia. The study observed that changes in both youth and old-age shares over a five year period have a negative effect in the short-run (five year).

In another study, Navaneethan (2002) used data from three South Asian and five South East Asian countries to determine the relationship between age structural transitions and economic growth. The study used Ordinary Least Squares (OLS) estimation technique for multiple regression analysis. The analytical techniques employed in the study were descriptive statistics as well as the OLS multiple regression technique. The study found out that macro-economic growth in South East Asian economic follow the life-cycle hypothesis. This is because the age share 25 - 49 have a significant negative impact on economic growth. Sundman (2011) used times series data to study the effects of Demographic transition on economic growth for Japan. Harrysong (2014) investigated the relationship between dependency rate and

economic growth in Sub-Saharan Africa. The study was conducted using a cross section of 26 Sub-Saharan African countries between 1985 and 2010.It would seems most of the studies reviewed have focused their attention on Asia and its environs as well as other regions in the analysis of the impact of demographic changes on economic growth. Few studies were conducted on Sub-Sahara Africa such as Harrysong (2014). However, the study only considered the dependency rate's impact on economic growth. There are relatively fewer studies of this nature that spotlighted the West Africa region.

Bloom, Canning and Malaney (1999) found a negative impact of population growth on economic growth but growth of the working population was found to have a positive impact on growth. Song (2013) also found a negative impact of population on growth as well as a positive impact of the working population on growth. The young population was also negatively related to economic growth, while the aging/elderly population has a positive impact on growth, but not significant. Ven& Smits (2011) also found results that are synonymous to the results found by Song (2013) on the impact the young population, the elderly population and the working class population. Thus there is more or less consensus on the impact of these three variables that measure demographic changes on economic growth, despite conducting the studies in different regions. However, the study of Ven& Smits (2011) did not model labour force participation rate and this is a critical component of the impact of the working class of the population on economic growth.

Sundman (2011) was more interested in the implications of demographic changes in Japan. He was motivated by a trend that shows that the richest countries in the world have aging populations with about one third of the population being in the elderly class. He sought to find out the impact of the elderly skewed population on economic growth, and the implications for Japan on the economic growth of the country due to speedy demographic transition using panel data analysis of 60 richest countries in the world. Similarly, Emelyanova (2015); Hyung (2013); Kunin (2009); Maestas, Mullen and Powell (2014); and Nagarajan, Teixeira and Silva (2013, 2016) studied the effects of population Aging on economic growth. While Nagarajan, Teixeira & Silva (2013, 2016) conducted a bibliometric analysis of the impact of population aging in economic growth using tables of bibliography summary, other studies conducted empirical analyses. Sundman (2011) found out that the high old age dependency ration has negative effects on economic growth, which was confirmed by other findings such as Maestas, Mullen and Powell (2014). Hyung (2013) found out that both the young and old age dependency ratio have negative effects on domestic savings and thus economic growth potentials. Moreover, the old age dependency ratio results persists with random and fixed effects results. However, Sundman (2011) did not consider the young dependency ratio in his study as the old age dependency ration was the study's main focus. Kunin (2009) on the contrary did not conduct an empirical analysis to determine the dimensions of population aging, on economic growth but used descriptive analysis. Similar tools of analysis were used in the study conducted by Emelyanova (2015) on the cross regional analysis of population aging in the Arctic.

Theoretical Literatures

The Demographic Transition Theory

The theory of demographic transition was developed by an American demographer Warren Thompson in 1929. The demographic transition theory is a generalized description of the changing pattern of principal demographic variables such as mortality, fertility and growth rates as societies move from one demographic regime to another. Basically, it implies a transition from trends of high birth and death rates to one of low birth and death rates. The transition from high birth and death rates is attributed to socio-economic advancement of a country or region from a pre-industrial to an industrial setting (Woods, 2000; Caldwell et al., 2006).

The demographic transition model began as a result of the classification of population differentiated by patterns of fertility and mortality. Three (3) different sets of countries with different population growth rates were identified (Thompson, 1929). The first set of countries was those with falling rates of increase and which were facing imminent population declines. In these set of countries, mortality is low, but their rapidly declining fertility made them first stationary and later a declining population. The countries of Western Europe were found to be among this class of countries. The second set of countries consists of countries which had both birth and death rates fallen, but death rates had declined earlier and more rapidly than birth rates. Thus their populations were growing sharply, until falling birth rates brought about a stationary and then later a declining population. The countries of Eastern and Southern Europe fell into this category of countries. The third set of countries were classified as Malthusian as neither their birth rates nor their death rates were under control. This group was said to contain about 70 -75% of the World's population. Japan, India and Russia were among the countries established to be in this third category. It was predicted that in three to four decades, countries in the third category would enter

the second category and those in second category would enter first (Kirk, 1996).

The demographic transition model presents four stages or phases in which every country must pass through by proceeding from one stage to the other. The first stages is characterized by socio-economic backwardness, pre-industrial society, poor scientific advancement and technological inertia. The stage is characterized by high death rates and birth rates which are roughly in balance. All human populations are believed to have had this balance until the late 18th century, when this balance ended in Western Europe. In fact, growth rates were less than 0.05% at least since the Agricultural Revolution over 10,000 years ago. The rate of population growth is typically very slow in this stage, because the society is constrained by the available food supply; therefore, unless the society develops new technologies to increase food production (e.g. discovers new sources of food or achieves higher crop yields), any fluctuations in birth rates are soon matched by death rates. The incidence of high fertilities and mortalities in this stage of development formed the basis of the Malthusian theory of population is the (Kirk, 1996).

The Unified Growth Theory

The Unified growth theory came on stage as a result of the inconsistencies of endogenous and exogenous neoclassical models of growth. The theory was advanced by OdedGalor and his associates in the year 2000. The Unified growth theory presents the transition from stagnation to growth over the course of human history in a single analytical framework, as product of transition through some stages which must be followed by countries in their growth path. The theory is based on micro-foundations which are consistent with the major characteristics of the entire economic growth process. The theory identifies three (3) major regimes, as well as describing five (5) stages of growth and economic development – Malthusian era, post Malthusian era and the sustained economic growth era. The theory carries elements of Malthusian theory as well as the Demographic Transition Theory. However, it hinges on some criticisms of the earlier theory (Galor, 2005, 2011).

The theory suggests that Malthusian stagnation characterized most of human history. Technological progress led to the expansion of population rather than improving living standards. In the post- Malthusian regime, the first phase of industrialization emerged resulting in capital accumulation and accelerated technological progress. During this era/ regime, both population growth and per-capita income rise, but temporarily. The modern growth regime features the emergence of human capital formation that complements and accelerated the pace of technological progress. These factors cause a substantial reduction in fertility rates and population growth resulting in a permanent escape from the Malthusian trap (Bliss, 2014; Galor, 2012).

The theory further explains the five stages in which every economy passes through, starting the era of Malthusian stagnation until it reaches the era of sustained economic growth. The stages are; first, the epoch of Malthusian stagnation that characterized most of human history. Second, the stage of escape from the Malthusian traps. Third, the stage of emergence of human capital formation in the process of development. Fourth, the onset of demographic transition. Fifth, the origins of the contemporary era of sustained economic growth and finally, the divergence in income per capita across countries (Galor, 2012).

This study adopts the Unified Growth Theory as its theoretical underpinning because of its explicit description of Malthusian and the Post Malthusian era, as well as the five stages of the Post Malthusian era. The fourth stage clearly explains demographic transition which means declines in fertility and mortality. The ensuing effect is demographic changes which will start with a very young population being high, then the swelling of the working population class that comes with demographic dividends. And later, the increase in aging population which will also have repercussions for growth. The clarity with which West Africa fits between the Malthusian era, the post Malthusian era and the stages that follow is what informed the adoption of this theory as a theoretical framework.

Methodology

This study adopted the use of dynamic panel data estimation techniques. Generalized Method of Moments (GMM) estimation techniques of system and difference GMM was used to estimate the relationship between the dependent variables and the regressors modeled in the study. Fifty three (53) African countries, with the exception of South Sudan, were used for the analysis of the data.

Dynamic panel models are panel data models that have the lagged dependent variable in the model.

.The econometrics form of the model is specified as;

$$RGDP_{it} = \Omega_i + \beta_i \sum_{j=1}^{p} Xit + \lambda it \quad - \quad - \quad - \quad - \quad - \quad (1)$$

Where;

Ω - is the constant intercept
β - is the slope parameters to be estimated,
X - is the vector of independent variables
λ - is the composite error term
i - is the individual country and *t* is the time

The dynamic panel model is specified as ;

$$Yit = \Omega i + Yit - 1 + \beta i \sum j = 1 Xit + \lambda it \quad - \quad - \quad - \quad - \quad - \quad - \quad (2)$$

Where Y_{it-1} is the lagged dependent, which captures the dynamic effect.

With the introduction of lagged dependent on the model, the model is now prone to the problem of autocorrelation and endogeneity, which affect the efficiency of the results. This has led to the development of the Generalized Method of Moment (GMM), which suggested the use of instruments in trying to address the problem. The GMM is decomposed into the difference GMM developed by Henderson and Hsiao(1981) and Arellano and Bond (1991) that suggest differencing the model and using the lagged values of the lagged dependence as the instrument to address both autocorrelation and endogeneity problems.

Model Specifications

The model used in this study was adopted from Bloom, Canning &Malaney (1999) however, with some modifications. The modifications became necessary because of the non- availability of some data, which is a common feature of some African countries. The original model had growth of Real GDP as the dependent variable, while the regressors are GDP per capita, GDP per worker, population located in tropics, access to ports, Quality of institutions, trade openness, years of secondary schooling, growth in total population, growth in working population, difference in growth of total and working population, ratio of working age population to total population, life expectancy coastal population density, and inland population density.

The model was modified to have real GDP as the dependent variable, and the regressors are fertility rate, life expectancy, young population, working population, aging population and prevalence of HIV/AIDS on the working population as a percentage. The young population and the aging population as well as the prevalence of HIV/AIDS on the working population are the variables included in the modified model, while other variables in the original model especially the geography-related variables were dropped.

The model is expressed as;

$$LnRGDP_{it} = \beta_0 RGDP_{it-1} + \beta_1 LnFER_{it} + \beta_2 LnLEX_{it} + \beta_3 LnYPP_{it} + \beta_4 LnWPP_{it} + \beta_5 LnAGP_{it} + \beta_6 LnPHOW_{it} + \mu_{it} \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad (3)$$

Where;

RGDP - Real Gross Domestic Product (proxy for Economic growth) measured at constant prices (inflation corrected).
FER - Fertility Rate (total births per woman)
LEX - Life Expectancy at birth (total)
YPP - Total Young Population (0 -14 years)
WPP - Total Working Population (15-65 years)
AGP - Total Aging population (65 years and above)
PHOW - Prevalence of HIV on working population (15-49 years) as a percentage of working population.
β_0 - β_6 - Regression Coefficients
μ_{it} - Random Error Term.
i - cross sectional dimension of the panel data
t - time series dimension of the panel data

Table 2: Data Description and Sources

Variables	Symbols	Data Sources
Real Gross domestic Product as a proxy for Economic Growth	RGDP	World Development Indicators data base, 2019.
Fertility Rate (total births per woman)	FER	World Development Indicators data base
Life Expectancy at birth (total)	LEX	World Development Indicators data base
Total Young Population (0 -14 years)	YPP	World Development Indicators data base
Total working population (15 -65 years)	WPP	World Development Indicators data base
Total aging population (65 years and above)	AGP	World Development Indicators data base
Prevalence of HIV on Working Population (15 -49 years) as a percentage of working population	PHOW	World Development Indicators data base

Source: Compiled by the Author (2019)

A priori expectations

$\beta1 > 0; \beta2 > 0; \beta3 < 0; \beta4 > 0; \beta5 > 0; \beta6 < 0$

The a priori expectation of the study suggests that the coefficient of Fertility rate will be positive, the coefficient of life expectancy should also be positive, the coefficient of the young population should be negative, the working and aging population should be positive as well, while the coefficient of the prevalence of HIV on the working population should be negative.

Results and Discussion

Table 3: Summary of Difference GMM and System GMM results

Variables	Difference GMM	System GMM
Lagged RGDP	0.8568555 (0.15)	0.9740036 (0.71)
FER	-0.0611579 (0.00)***	0.0292817 (0.00)***
LEX	0.1323739 (0.01) **	0.1191899(0.02)**
YPP	0.1273359 (0.00) ***	-0.0207629(0.00)***
WPP	0.144716 (0.00)***	0.0435372 (0.00)***
AGP	0.1340153(0.01) **	0.0977506 (0.00)***
PHOW	-0.0013904(0.00)***	-0.0048211 (0.00)***
N	1297	1348
Wald (X^2)	17.45 (0.014) **	4.59e+06 (0.0000)***
AR (1)	-0.16003 (0.87)	-0.68029 (0.4963)

Source: Author's computation using STATA 12, 2019.

Note: the (***), (**) signifies variables that are significant at 1% and 5% respectively. Probabilities in parenthesis.

The result of the system GMM was interpreted because of its advantage and efficiency (less bias and more precision) than the Difference GMM result. The Lagged dependent variable $RGDP_{-1}$ was found to have a positive but statistically insignificant impact on the Economic growth (RGDP) of African countries. Fertility rate (FER) was found to have a positive and statistically significant impact on RGDP. A 1% increase in Fertility rate, will cause a 2% increase RGDP. Life expectancy (LEX) was also found to have a positive and statistically significant impact on Economic growth. A 1% increase in Life expectancy will cause an 11% increase in economic growth (RGDP), which suggests that African countries need increase in life expectancy more than increase in fertility. The Young Population (0 -14) has a negative and significant impact on economic growth. An increase in the share of the population 0 -14 by 1% will decrease economic growth by 2%. On the contrary, the Working population has a positive impact on economic growth, such that a 1% increase in the Working population will lead to a 4% increase in the economic growth of African countries. However, the aging population (AGP) has a more significant contribution to economic growth. The impact of the Aging population is such that a 1% increase in the proportion of population 65 and above, results in about 9% increase in economic growth. The prevalence of HIV/AIDS on the working population as a percentage of the total population was found to have a negative impact on economic growth. Thus, a 1% increase in the prevalence of HIV/AIDS on working population will lead to a 0.0048 percentage points, decrease in Economic growth.

The findings of this study are consistent with Song (2013); Ven& Smits (2011), who modeled the growth rates of the young population in their studies and found a negative relationship between the young population and economic growth rates. Harrysong (2014) modeled the dependency ratio as a whole and found that it has a negative effect on growth. Although the young population is one component of the dependency ratio, the results are synonymous to a large extent. Hyung (2013) however, found out that both the young and aging populations have negative impact on economic growth; however, this is contrary to the findings of this study on the part of the aging population.

Sundman (2011) found that a high old age dependency ratio has negative effects on economic growth, which was confirmed by other findings such as Maestas, Mullen & Powell (2014). This is not the case for African countries as they cannot boast of high life expectancy. Therefore, one cannot say that there is a high old age dependency ratio. This may have accounted for the difference in results between this study and the studies by Sundman (2011) and Maestas, Mullen & Powell (2014).

The working population has been found to have a positive impact on the economic growth rates. This has been consistent to almost all previous studies that have modeled this variable such as Bloom, Canning &Malaney (1999). On the impact of this variable on the economic growth, there is a consensus, that the working population has a positive impact on economic growth of nations. Almost all the studies empirically reviewed have confirmed this relationship.

Conclusion and Recommendations

The young population has a negative impact on the economic growth of African countries, while the active and aging populations both have positive impact on the population of African countries. Thus, the continent has to enact some policies that will apply brakes to their high fertility rates as it increases the number of young population, which is negatively affecting the economic growth of economies of the continent, while also working towards increase life expectancies. This is a necessary course of action if they want to achieve remarkable growth rates as was experienced by the countries of East Asia and other regions that have benefitted from the demographic bonus.

The study therefore recommends the following;

1. The governments of the African countries should put appropriate policies in place to invest in the health and well-being of their population, through better health care delivery service systems, so as to increase life expectancies and reap significant economic growth rates.
2. African countries should step up their fight against HIV/AIDS through mass public enlightenment and other pragmatic measures as it directly affects the working population and it affects economic growth indirectly.

References

Agwanda, A. & Amani, H.(2014).Population growth, structure and momentum in Tanzania. *Economic and Social Research Foundation (ESRF) discussion paper no. 61. Retrieved from www.thdr.or.tz/docs/THDR-BP-7/pdf*

Ashford, L. S. (2009). Africa's youthful population: Risk or opportunity? *USAID, population Reference Bureau. Website: www.prb.org.*

Bliss, C. (2014). Unified growth theory. *The European Legacy- Towards New Paradigms 19(1): 98 – 99.*

Bloom, D.E., Canning, D. &Rosenberg, L. (2011).Demographic change and economic growth in South East Asia. Working paper series. *Programme on the global demography of aging PGDA Working papers No. 67.*

Bloom, D.E., Canning, D. &Malaney, P.N. (1999). Demographic change and economic growth in Asia. *Centre for International Development, Harvard University, Working Paper No. 15.*

Bloom, D.E., Canning, D. &Sevilla, J. (2001). Economic growth and the demographic transition. *National Bureau of Economic research (NBER) working paper No. 8685*

Bloom, D.E., Humair, S., Rosenberg, L., Sevilla,J.P. &Trussell, J. (2013) A demographic dividend for Sub-Saharan Africa: Source, magnitude, and realization. *PGDA Working Paper No. 110. Retrieved August 2018 from http://www.hsph.harvard.edu/pgda/working.htm.*

Bloom, D.E., Canning, D., Fink, G., & Finlay, J.E. (2007). Does age structure forecast economic growth? *National Bureau of Economic Research working paper 13221. www.nber.org/papers/w13221.*

Bloom, David E. & J. G. Williamson (1998). "Demographic transitions and economic miracles in emerging Asia." *World Bank Economic Review 12(3): 419-56.*

Caldwell, J. C., Caldwell B. K.; Pat C. McDonald, P.F.& Thomas, S. (2006). Demographic transition theory. Dordrecht, The Netherlands: *Springer:* 239. *ISBN 1-4020-4373-2.*

Canning, D., Raja, S.,&Yazbeck, A.S. (2015). Africa's demographic transition; Dividends or Disaster. *Africa Development Forum. World Bank Group. www.worldbank.org*

ECOWAS-SWAC/OECD (2007). Demographic Trends: Atlas of regional Integration in West Africa. *Population Series.*

Emelyanova, A. (2015). Cross regional analysis of population aging in the Arctic. *A Ph.D Dissertation submitted to the department of Economics UniversitatisOuluensis.*

Estwood, R. & Lipton, M. (2011). Demographic transition in Sub-Sahara Africa. How big

will the economic dividend be? *Population studies 1 -27*

Feng, W.(2005).Demographic Dividends and Prospects for Economic Development In China. *Paper prepared for UN Expert Group Meeting on Social and Economic Implications of Changing Population Age Structures, Mexico City, August 31-September 2, 2005.*

Galor, O. (2005). "From Stagnation to Growth: Unified Growth Theory". *Handbook of Economic Growth. Elsevier 1(1): 171–293.*

Galor, O. (2011). "The demographic transition: causes and consequences". *Cliometrica. 6(1): 1–28.* doi:10.1007/s11698-011-0062-7. PMC 4116081. PMID 25089157

Galor, O. (2012). Unified growth theory and comparative economic development. *Retrieved 26th January, 2018 from www.biu.ac.il/soc/ec/students/mini_courses/6_12/data/UGT-Luxembourg.pdf.*

Gavrilova, N.S. &Gavrilov, L.A. (2009). Rapidly aging population: Russia/Eastern Europe. *International Handbook of Population Aging doi:10.1007/978-1-4020-8356-3-6. Springer science and Business Media.*

Harrysong, A.(2014). Is there a relationship between dependency rate and economic growth? A study of demographic dividends in Sub- Sahara Africa. *Bachelor's Thesis, Sodertorns University, School of social sciences*

Henderson, T. W & Hsiao, C. (1981). Estimation of Dynamic Models with Error Components. *American Journal of StatisticalAssociation, Vol. 76, 598-606*.

Hyung, J. (2013). An Analysis on the Effect of Old Age DependencyRatio on Domestic Saving Rate. *Under the direction of Professor Ronald LeeUniversity of California, BerkeleyDepartment of Economics.*

Kirk, D. *(1996).*Demographic transition theory. *Population Studies 50:361-387.doi:10:1080/0032472031000149536.*

Kunin, R. (2009). Population aging: Economic and social dimensions: *A Paper prepared for the Business Council of British Columbia Outlook 2020 Project.*

Lindh, T. & Malmberg, B. (1999).“Age structure effects and growth in the OECD”, 1950-1990.*Journal of Population Economics, 12: 431-449.*

Maestas, N., Mullen,K.,& Powell, D. (2014). The Effect of Population Aging on Economic Growth.

Mirkin. B. & Weinberger, M.B. (2014). The demography of population aging. *Population division. United Nations Secretariat.*

Nagarajan, N.R., Teixeira, A.A.C.& Silva, S.T.(2016). The impact of an aging population on economic growth: an exploratory Review of the main mechanisms. *Analise socials 218:2182-2999.*

Organization of Economic Corporation and Development (2018). Young population indicator. Retrieved January 24th 2018 from www.data.oecd.org/pop/young-population.htm.

Sundman, M. (2011). The effects of demographic transition on economic growth for Japan. *Bachelor's Thesis within Economics. Jonkoping International Business School.*

Navaneetham, K. (2002). Age structural transition and economic growth: evidence from South and South East Asia. *Asian Meta Centre for Population and Sustainable Development Analysis. National University of Singapore.*

Song, S. (2013). Demographic changes and economic growth: Empirical evidence from Asia. *Honours project; Illionois Weslayan University Digital commons @IWU Economic Department*.

Thompson, W.S. (1929). Population. *American journal of sociology 34:959 -975.*

UNDP (2015). World Population aging. United Nations Populations department. Department of Economic and social affairs. ST/ESA/SER.A/390. Retrieved March 21st 2018 from www.un.org/en/development/desa/population/publication/pdf/aging/WPA2015report.Pdf

UNDESA (2004). World Population Prospects. *The 2004 Revision Volume III: Analytical Report, 2004.*

Ven, R. and Smits, J.(2011). The demographic window of opportunity; age structure and Sub-national economic growth in Developing countries. *Nijmegen centre for economics (NiCE). Radboud university, Nijmegen working papers.*

Woods, R. (2000). The demography of Victorian England and Wales. *Cambridge University Press. P. 18. ISBN 978-0-521-78254-8.*

World Bank (2018). World development indicators database: countries' indicators. *Retrieved September 10, 2018 from www.worldbank.org.*