THE EFFECT OF POPULATION GROWTH ON THE ECONOMIC GROWTH OF 43 SUB-SAHARAN AFRICAN COUNTRIES: PANEL DATA ANALYSIS (1990-2019)

By

TESSEMA, Henok Fantahun

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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Abstract

Africa is expected to contribute more than half of the global demographic expansion between now and 2050. By 2050, Sub-Saharan Africa's population is predicted to double. According to the World Bank, recent drops in the birth rate in Sub-Saharan Africa imply that the working ages (25 to 64 years) population is rising more rapidly than those of different age groups, increasing the likelihood of economic expansion. Using a panel data methodology, the paper investigates the effect of demographic expansion on the economy of 43 Sub-Saharan African countries from 1990 to 2019. The analysis employed annual secondary data from the database of development indicators of the World Bank and from the database of world economic outlook of IMF. Besides the analysis of descriptive statistics, panel model of random and fixed effects have been used to observe the data. The results of both models of fixed and random effects analysis revealed a one-to-one correlation between GDP per capita growth and population surge, suggesting that demographic expansion benefits the economy. The study recommends that Sub-Saharan African countries design and execute realistic population policy initiatives to increase the productivity level of their population to reap larger demographic dividend gains.

Introduction

Africa remains economically expanding and the second most populous continent in the world. According to the Worldometer 2020 estimation, the population number in Africa is estimated at more than 1.3 billion. The United Nations (UN) projected the addition of almost 1 billion people to the existing 7.7 billion world population by 2030 (UN, 2019). According to the report, of this addition, the Sub-Saharan African countries might provide well above half of the increase in population. In comparison to different areas of the globe, the region's demography has been growing fast. According to the UN's World Population Prospect 2019, Sub-Saharan Africa's population is growing at a pace of 2.7 percent per year, more than double that of South Asia (1.2 percent) and Latin America (0.9 percent). The youth population characterizes and constitutes the majority of Africa's demography. Africa becomes the youngest continent in the world, including over 60% of its inhabitants under the age of 25. The adolescent fertility rate, the number of births per 1,000 women aged 15 to 19, is greatest in Sub-Saharan Africa, at 104 per 1,000 women, followed by Latin America and the Caribbean, at 63 per 1,000 (United Nations World Population Prospects 2019: 28). The report also estimated that the life expectancy at birth of the region was 61.1 which is even less than the average of 65.2 of the least developed nations. Furthermore, economically Sub-Saharan Africa remains to be the continent's poorest region.

Sub-Saharan Africa remained the only significant sub-continent determined short of any evidence that fertility transitions had started in the world. However, it became evident at the beginning of the 1990s that changes were happening and that fertility began to decline in at least a few nations in the region. Fertility rates have been declining in countries such as Kenya, Ghana, Gabon, Senegal, South Africa, and Ivory Coast, for instance. However, in relation to the overall number of nations in the sub-region, these rates remained negligible.

Research question

The major research question of the paper is

"What is the effect of population growth rate on the economic growth of sub-Saharan African countries?"

The controversy over the population-economic growth relationship has a long history. The impact of population expansion on the economy has become the topic of vigorous scholarly controversy after the publishing of Malthus' population study. If a nation's population growth is negatively correspond with its development performance, the countries' population expansion is expected to hinder its economic progress. The opposite will be true if the relationship is positive. This is due to the fast rise of the population, which increases the dependency load of individuals deemed to be financially weak, such as the elderly and children. As Sala I Martin, et al. (2004) pointed out, several variables could influence the economic development of a nation. However, the extent of the influence of a demographic expansion on economic growth remains unknown and controversial. The type of impact of an increase in population on economic development remains an open and debatable topic. Many researchers have regarded the disparity between demography and general global resources, as well as their consequence of such inequality specifically as a major issue since the book of Malthus *'An Essay on the Principle of Population*'. Ever since Malthus became alerted about the "demographic explosion" and its dangers, negative perspectives on population growth have dominated over favorable ones.

In general, there have been three opposing viewpoints that have tried to explain the linkage between demographic factors and a country's economy. The first theory, starting from the theory of Malthus, 1798, concluded that population growth negatively impacts economic

growth by putting a strain on natural resources and the climate, whether by natural growth or (net) immigration. A population pressure stifles countries' economies as suggested by (Cropper and Griffith, 1994) and (Bongaarts, 1996). Optimists, on the contrary, observe demographic expansion as an advantage to economic growth. Population expansion increases large-scale production and specialization, resulting in better human resources, that encourage technological advancements and, as a result, contribute to economic expansion (Klasen and Nestmann, 2006; Simon, 1995). The third theory holds a more moderate viewpoint. It concludes that there is barely any data linking demographic expansion with an economy (Gallup, et al., 1998; Thornton, 2001; Bloom and Freeman, 1988). The population's age structure might have an impact on economic growth in addition to steady-state population growth.

The Sub-Saharan African countries have a larger birth rate as well as a higher death rate. The region's young population makes up the majority of its demography. In advanced nations, the interplay of an aging population and low fertility rates has raised fears that a declining workforce would damage budgets and living standards; however, the opposite is true in emerging nations (Mora, Engelman, and, Crist 2017). According to Prskawetz and Barthel (2007), the positive effect of a population on an economy is dependent on the population's age framework and the adverse effect is limitedly dependent on the demography's age distribution. An article by Canning, Malaney, and Bloom (1999) reported an adverse effect of population expansion on an economy, while an increase in economically active population has a significant beneficial effect. Given Africa's economical backwardness and high population growth rates, does this conclusion apply to the region?

Even though there is little previous research on the African continent on the influence of demographic pressure on its economy utilizing a panel data methodology, most do not cover all

African countries, and time coverage was also small. These research papers employed various analysis techniques, time-scope, and reported different results in the effect of population growth on an economy. Notable research papers have nevertheless been carried out on the effect of demographic trends on the Sub-Saharan African countries (Akintunde et al., 2013). Therefore, the paper attempts to investigate the impact of population expansion on 43[1] sub-Saharan countries from 1990-to 2019 employing a panel data methodology. In most emerging economies, the sub-Saharan African countries particularly, the subject of demography-economy interaction appears to be less contested. This region also continues to be an example of the detrimental influence of a population on economic growth, even though studies argue that population could have a beneficial or adverse impact on the economy. Sub- Saharan Africa has characteristic features that may undercut such advantages for those who stress the favorable effects of demographic factors. Some argued that the sub-Saharan region has an equal prospect of reaping the benefits of the economic advantages of demographic dividends as the rest of the world that arise from decreased fertility and mortality rates and an expansion in the economically active people (Bloom, et al. 2007). Nonetheless, the authors observed that attaining this advantage is dependent on the quality of institutions and that Africa's average institutional quality remained lower than the world average. Although sub-Saharan Africa possesses an equal potential with the rest of the globe, (Bloom et al., 2007:2) noted that Africa remains an anomaly while most parts of the globe are undergoing demographic transitions. Regardless of Sub-Saharan Africa's lesser demographic transition in comparison to the entire globe and the massive policy ramifications, it

[1] The countries are Angola, Benin, Botswana, Burkina Faso, Burundi, Cape-Verd, Cameroon, the Central African Republic, Chad, Comoros, Congo, Dem. Rep. Congo, Cote d'Ivoire, Equatorial Guinea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

appears that foreign politicians and advisors choose to neglect population matters in the periphery. The UN has overlooked the issue of controlling rising fertility rates and huge impact population growth has on the environment and the countries in general in emerging nations, particularly in the Sub-Saharan region since it is missing from the SDG.

Literature Review

The Malthusian demographic philosophy has prompted a lot of debate in economic circles about the correlation between demographic expansion and development. The view of Malthus on population growth was considered to be pessimistic. According to the Malthusian theory, the food supply will be unable to keep up with population increase, leading to disease, starvation, conflict, and disaster. Malthus, regarded as a 'prophet of doom or pessimist', reported in the end of the 1790s, questioning if the "upcoming development of humanity" was conceivable in the event of a rising population (Bloom et al., 2001). Moreover, he postulated that food supplies grow arithmetically, while the population tends to rise geometrically. The model of Malthus is mainly concerned with this dynamic interplay between population expansion and human progress. The dynamic connection between demographic expansion and global prosperity was at the heart of the Malthusian paradigm. One significant issue seems to be overlooked by the theory: technological improvement and its impact on food productivity growth. Under the growth model of neoclassical, a Malthusian model extension, demographic expansion could lower the level of economic progress called the dilution of capital. Using a Malthusian context, Ehrlich and Kim (2005) explained contradictory historical evidence of the population-economy linkage since the days of Malthus. The analysis confirmed the theory of Malthus in the pre-industrial period, but that it failed to work in the post-industrial era.

Three common viewpoints on the population-economic growth relationship have emerged following the debates on the effect of demographic expansion. According to pessimists, population pressure has a detrimental effect on countries' progress to a degree that demographic expansion, whether through birth rate, death rate, or immigration, places strain on the environment and natural resources. The resulting condition stifles economic development and growth (Yeboah et al., 2001; Bongaarts, 1996; Cropper and Griffith, 1994). Generally, skeptics highlight a growing income disparity and a decline in the standard of living among people due to population growth.

Advocates of population growth, on the other hand, see it as an advantage to economic progress and development. In fact, through expanding specialization and large-scale production, a demographic expansion leads to enhanced human capital, that allows technical improvements, which in turn contributes to economic progress (Barro 1991, 2001; Klasen and Nestmann, 2006; Simon, 1995; Kuznets, 1973). Revisionists or neutralists pronounce a more moderate position, known as the third view, on population growth and its effect on economic growth. According to neutralists, there is hardly any evidence on the linkage between demographic expansion and economic development (Gallup, et al., 1998; Freeman and Bloom, 1988; Bloom, et al., 2003; Thornton, 2001). In the latest empirical study on the subject matter of the linkage of economic growth and population, they backed pessimists or optimists, while the neutralists' position has been mostly unsupported (Hamza, 2015).

The demographic shift aims to clarify the reason all the present industrialized countries went across the same three phases of contemporary demographic development. During the first stage, there is higher mortality and a higher fertility rate. In the second phase, there are fewer deaths and increased birth rates. The advancements in medical technology helped decrease the

death rate, but this has had little effect on fertility rates. At the third stage, both the mortality rate and fertility rates are lower. The demographic shift/transition is complete at this stage, and the intensity of modernization has increased. Currently, the majority of advanced nations are on the third stage of the demographic phase. Nevertheless, the theory of demographic transition is criticized for not being relevant/applicable to less developed countries. For instance, In North America, Europe, and Japan, where data on the population has been accessible for a long time, the demographic transition model has been verified, but for most LDCs, good quality demographic data has just lately been available. According to Bongaarts and Bulatao (1999), at this stage, the sub-Saharan countries are unable to reap the benefit of population dividends. In Sub-Saharan Africa, we take a more differentiated view and provide a bright forecast for those nations with the proper institutions in place.

Fertility, death, and migration rates are primary indicators of population growth. In many instances, there are extremely few examples of relocation of peoples to Africa from other continents with a small occasion of within Africa migration (like from other countries to South Africa). Fertility rates are high, which means that the population is growing at a rapid rate. With the exception of Africa, most countries (especially most industrialized nations) have significantly minimized their fertility and mortality rates. Despite a reduction in overall fertility rates, the level of birth rates remains high, and Sub-Saharan Africa's amount of population growth is unacceptably high by global standards. There are still over 4.5 births per woman in the African continent. However, they are showing a reduction and, in a few instances, have halted (Bamiwuye, Odimegwu, and, Adedini, 2015; Bongaarts, 2005).

African countries have higher birth rates and a youth dependence ratio, both of which contribute to economic slump (Akintunde, et al 2013). A higher birth rate contributes to a low

real GDP per person and will lead to macroeconomic and microeconomic causes contributing to poorer economic growth. At a household level, a higher number of children will lead to lesser human capital investment in the children's future (education, diet, and well-being). At a national level, higher fertility forces central governing bodies to spend less money on upgrading average services per person since it places excessive strain on the country's budget. Even in wealthy nations, poverty and fertility have a substantial positive relationship. High fertility rate countries have smaller income per capita ratios. The Total Fertility Rate is recognized to statistically significantly and negatively affect economic growth. Less Developed Countries may influence the world population by implementing policies that target lowering overall birth ratios, especially in the continent, and assure the completion of the demographic transition (Sachs, 2008).

Due to inadequate economic development and a lack of medical services, especially in rural regions, Africa's mortality rate remains high. Infants, mothers, small children, and the elderly have the highest death rates per 1000 persons. Sub-Saharan Africa has the highest under-five mortality ratio in the universe, with 74.2 deaths per 1000 live births, according to the UN's World Population Prospects (2019). The report also mentioned that a baby born in Sub-Saharan Africa is twenty times more probably to die before reaching the age of five than a child born in Australia/New Zealand.

Akintunde, et al. (2013) explored the impact of population fertility and mortality rates on the economy of the countries of Sub-Saharan Africa from 1970 to 2005. They used a dynamic panel data analysis and pooled OLS to approximate the variables and concluded that life expectancy at birth positively affects their economic growth while the total fertility rate harms economic growth. They did not use data related to age structure due to the non-availability. Likewise, South Korea's age structure has enhanced its economic performance as An and Jeon

(2006) determined. Moreover, Bloom et al (2006) studied the influence on income per capita in China and India of mortality and fertility, and age structure. They concluded that increased life expectancy at birth boosted economic growth. and that lower fertility rates, particularly in India, would stimulate economic growth. Their findings, however, did not show that education has a beneficial influence on economic growth of the countries.

Empirical literature

For demographers and economists, as well as policymakers, the inquiry of if there exist a causal association between economic development and demographic expansion is still of great importance. Nonetheless, the linkage still remains debatable. Though theoretically, population expansion appears to have a detrimental consequence on an economy, there has been no conclusive factual evidence to support this. This is not the case in certain countries such as the BRICS countries (Brazil, the Russian Federation, India, China, and South Africa), where population growth appears to be beneficial. As a result, interpretations of the impact of population expansion on the economy continue to diverge.

Several studies have been conducted to obtain a common consensus on the relationship between the two, employing a variety of methodologies and data from different countries. However, the answer to this issue has remained uncertain since one study discovered a positive correlation while another reported a negative one. Regardless of how contradictory the conclusions on the connection between demographic expansion and economic development are, economic academics and researchers continue to present numerous studies to back up or refute their claims. Many empirical-based research have been conducted on the relation between demography and economic development with mixed results. Cassen (1976) provided a good

overview of the linkage or relationship between economic growth and population growth. This article explored factors influencing mortality and fertility and underlines the development type which affects population dynamic. There is also A. Peter and H. Bakari (2018), T.Chang, H. Chu, F. Deale, and R. Gupta (2014), N. Mamingi and J. Perch (2013), etc.

Sub-Saharan Africa is the poorest part of Africa and the most populated. According to the UN's World Population Prospect (2019), Sub-Saharan Africa will account for the majority of global population increase in the future decades, while numerous other areas will see population declines. The report also estimated that 1.05 billion (52 percent) of the supplementary 2 billion individuals who might join the world residents between 2019 and 2050 could be added to Sub-Saharan African countries. According to the estimate, the Sub-Saharan region would outnumber both Central and South-Eastern Asia and Eastern and Southern Asia in terms of population number by 2062, making it the most populous of the world's eight geographic zones.

Population growth, according to some research, has a detrimental consequence on economic growth. According to Hamza (2015), demographic variables (net migration, mortality and birth sizes) and sustained growth were found to be negatively correlated in developing nations. Other research, Oladeji, Akintunde, and Olomola (2013); Mora, Engelman, and Crist (2017), indicated that the demographic expansion in Sub-Saharan Africa has an adverse consequence on the economy, food security, and biodiversity. Nonetheless, in Sub-Saharan Africa, they discovered a favorable relation between life expectancy and growth in the economy. According to a study by Malaney, Bloom, and Canning (1999), demographic growth in Asia has a significant negative influence on the region's development. Contrary to this major finding, they discovered a positive correlation between growth in the economy and an expansion of the working-age population. To adjust for reverse causality in the model, the authors included

instrumental variables and the results remained statistically significant. They also reported that population density along the shore was found to be beneficial, but the inland population density affected the population negatively. In addition, Arokiasamy, Barik, and Basu (2013) discovered that an increase in the proportion of the working-age population has a beneficial and substantial effect on the growth of the BRICS economies. This study's findings are similar to those of Canning, Malaney, and Bloom, (1999). These studies, however, have failed to show a direct link between demographic growth and the economy. However, the fundamental concern here is not the effects of the economically fit population, but rather the general population. In addition to Essien (2016), studies by Mohammed, Peter, and Tartiyus (2015) and Okwara, Nwosu, and, Dike (2014) concluded that the country's expanding population has a beneficial impact on Nigeria's economic growth potential. As the review demonstrates, there are more optimists than pessimists when it comes to economic growth-population growth linkage.

By using panel data analytical methods which were applied on a cross-section of 30 developing nations from Asia, Latin America, and Africa for a period of 14 years (2001 -2014), Hamza (2015) studied their linkage. The random effect model, causality analysis, panel unit root analysis, and cointegration analysis were all used to examine the data. Pooled OLS was not used in this study, and as a result, the result ignored the influence of omitted variables. However, dynamic panels were not used to evaluate the linkage between demography and the economy in the study. The Gaussian Mixture Model (GMM) estimators have a high degree of consistency and remained asymptotically normally distributed. There was no analysis of the effect of the population on economic growth in developing nations; instead, only net migration, death rates, and birth rates were looked at and their consequence on the economy was assessed.

Olomola, Oladeji, and Akintunde (2013) used dynamic panel data analysis (difference and system GMM) to look at demographic changes and economic development in Sub-Saharan Africa. Because dynamic panels are convenient to investigate dynamic relationships within a panel data framework, no Pooled OLS, random, or fixed-effect models were used in this study. The study did offer descriptively important population and economic information, but it failed to apply the causality test, which would have provided greater intuition. However, because the study did not apply Pooled OLS, the results were not likely influenced by omitted variable bias. For the period 1870 and 2013, Gupta, Chu Deale, and Chang (2015) applied a bootstrapped panel causality test to examine the link between demography and the economy. Static and dynamic estimate approaches were not used in this study, making it unique. Accordingly, the study pointed out the relationship between population and economic growth based on the causality test. In addition, causation was shown to vary among different countries. Researchers Canning, Malaney, and Bloom conducted an analysis on demographic change and the Asian economy (1999). Multiple regression and dynamic panel analysis were used in the research. Since the study didn't employ Pooled OLS, the issue of estimation bias caused by omitted variables was avoided. The paper analyzed the effect on the economic progress of the economically fit population, including the impact of the population as a whole on economic development. Engelman, Mora, and Crist (2017) employed graphs to present descriptive statistics to demonstrate the connection between population growth and the environment.

Basu, Barik, and Arokiasamy (2013) employed panel data analysis to examine population variables of economic development in BRICS countries and a few other industrialized countries. Panel data analysis of random and fixed effect was mostly used, which prevented estimation bias owing to omitted variable bias. Essien (2016), Okwara, Nwosu, and Dike (2014), and Peter,

Tartiyus, and Mohammed (2015) all applied time series analysis to examine the link between population growth and economic growth in Nigeria. Peter and Bakari (2019) employed dynamic panel data methods, difference and system GMM, to analyze the effect of population growth on the economy of 53 African nations for the year from 1980 to 2015. The authors reported that the fertility rate affects the economy negatively. However, the authors also reported that population growth affects economic growth positively. This result is somewhat confusing as the authors failed to explain the difference between population growth and fertility rates.

Chang, et al. (2014) applied the bootstrap panel causality test that takes into account both heterogeneity and dependency across countries to inspect the causal connection between the economy and population growth of 21 nations for the time 1870-2013. Accordingly, the authors reported one-way Granger causality flowing from population growth to economic growth. However, the authors did not mention whether the relationship is positive or negative. Another study by Akintunde et al. (2013) analyzed the impact of death and birth rates on economic development in sub-Saharan Africa from 1979-2005 for the five-year average using pooled OLS and dynamic panel data analysis and conveyed that a total fertility rate negatively affects an economic development whereas life expectancy at birth had a desirable effect on the economy.

A panel data analysis of the long-run association between economic development and the population of 30 of the most populated nations by Sibe et al. (2016) using the Augmented Dickey-Fuller test of stationarity and Error Correction Model (ECM) revealed that there exists a long-run relationship and bidirectional causality between these two variables. Furthermore, a paper by Peterson (2017) on the connection between economic development and a population increase over the past 200 years confirmed that lower population growth in high-income countries is problematic, while high population growth in poor countries negatively affects their

economic growth. Furoka (2009) looked at the long-run relationship between these two variables in the case of Thailand using the bound test and concluded that there exists a positive long-run equilibrium relationship and unidirectional causality from population growth to economic development.

A similar study on the effect of demographic pressure on the economic growth of Ethiopia applying Autoregressive Distributed Lag (ARDL) methodology over the period 1980/81-2018/19 using time series data, Alemu (2020) proved that a positive relationship and a strong bidirectional causality existed between these two variables. Another paper by Klasen and Lawson (2007) examined this similar issue using both macro and micro-econometric approaches for the Ugandan case and stated that the high demographic expansion in the country significantly and negatively affects per capita growth in the country. They also concluded that high population expansion is the major cause for a lower accomplishment in a misery avoidance journey and persistent families' poverty.

Concerning realizing a demographic dividend, David E. Bloom et al. (2007) concluded that "with the right and concrete institutional setup and environment most African countries have the capability to earn the advantage of the demographic dividend, but that firm institution will be critical for its attainment". The authors defined an institution in terms of the presence of rule of law, bureaucratic efficiency, liberty, corruption and risk of expropriation, an open political system, open market, non-black market, liberty of political expression, and lack of censorship. The authors recognized the unsuccessfulness of the population shift in achieving the demographic dividend in the absence of excellent institutions, which most Sub-Saharan African countries lack. Nations will also be sluggish to adjust to the shifting age structure if the proper policy framework is not in place, and will lose the chance of achieving huge progress. When an

increase in the number of economically-active citizens is not paired with an equal rise in work potentials, grave consequences will follow like growing joblessness, and likely more wrongdoings and political conflict. Robust organizations which can win the trusts of peoples and markets may assist nations in possibly reaping the benefits of demographic transitions.

Research Method

Africa is an ethno-culturally rich and geographically diverse continent with fifty-four countries. Sub-Saharan Africa has 48 countries. The region has the world's lowest total GDP and is the poorest both in the continent and in the world. The countries' average GDP per capita is one-fifth of the world average. According to the world bank, the region's population has grown from 186 million to 856 million from 1950 to 2010. The population growth rate, according to the world bank, in 2019 was 2.66 percent. If the trend growth rate continues at this rate, the population of sub-Saharan Africa could be as large as 2.4 billion by 2050.

The high rate of population growth being added every year has been putting pressure on sub-Saharan African countries in terms of food shortage, youth unemployment, environmental degradation, and conflicts. The governments of these countries have been struggling to cope with the high demographic explosion and reconcile this phenomenon with economic growth targets. Birth, death, and migration rates are the major factors of population dynamics in any country. Migration from other continents to Africa is extremely unusual in most circumstances, with just a few occurrences of intra-continent migration occurring between countries of Africa. Research-based analysis of the demographic factor is crucial to design and implement effective policy measures to subside its multifaced problems.

The Sub-Saharan Africa region has seen stronger population expansion and lower per capita income. The major intention of the study is to examine the effect of a demographic factor on the economy of sub-Saharan African countries using panel data methodology.

The specific purposes of the study are to:

1. Examine the effect of governments' education (human capital) expenditure on economic growth.
2. Investigate the effect of Investment on an economy.

Although the majority of these studies have been conducted in developing countries (e.g., East Asia), there exist limited research in Sub-Saharan Africa (Akintunde, Olomola, Oladeji, 2013). This research was conducted bearing in mind this reality. Any research focusing on the influence of demographic pressure is important, as it is linked to and magnifies the majority of Africa's problems. Population growth plays a significant role in the governments' attempt to create fair and equitable economic growth. The research paper will hopefully provide the sub-Saharan African countries with a policy alternative to mitigate the consequence of the population surge in their economies. It can also suggest applicable policy measures to be taken to enjoy economic growth potential from the demographic dividend that can result from a decrease in birth and death rates. This paper may potentially spark academic understanding of the still debatable topic of the connection between economic development and population expansion in the context of the countries of Sub-Saharan Africa.

Data Types and Sources

The approach followed in this research thesis is entirely quantitative. The study will rely on secondary data collected from the World Bank's Development Indicators' Database and

IMF's World Economic Outlook Database. The countries of focus are 43 sub-Saharan African countries. Five countries, namely Liberia, Eritrea, Somalia, South Sudan, and Sao Tome and Principe are dropped due to a lack of data on most of the variables.

Methodology and Model

Panel data analysis will be employed to analyze the effect demographic pressure put on the economy of sub-Saharan African countries. The general model is

$GDPcap_{it} = f$ *(population, investment, educational expenditure, balance of trade, gross saving)*

$$GDPcap_{it} = \beta_0 + \beta_1 Pop_{it} + Z_{it} + a_i + u_{it}$$

Where:

GDPgr is the growth rate of per capita GDP for the country (i) at time (t)

Pop- annual population growth rate

Z- control variables like investment, government expenditure on education, net official development assistance, and gross saving.

α - Country fixed effect

u- error term

This study first used descriptive statistics to conduct a comparative analysis of dependent and independent variables. The panel model allows controlling for the effect of unobserved variables like cultural differences and other socio-economic environments. The Hausman test will help identify whether the model is fixed effect or random effect. The variance inflation

factor (vif), Breusch-Pagan/Cook-Weisberg test for heteroskedasticity, and Shapiro-Wilk test have been applied to test for multicollinearity, heteroscedasticity, and normality of the data.

Results and Discussions

A. Descriptive statistics

The descriptive statistics of Sub-Saharan African countries on the variables GDP per capita growth rate, population growth rate, investment rate, gross saving rate, and government expenditure on education are presented in table 1. The study, on the other hand, is interested in the descriptive statistics of the population growth rate. The average population growth rate of sub-Saharan African countries is close to 2.5 percent. This growth rate is the highest among the other continents in the world. The GDP per capita growth rate of the region on average is 1.6 percent.

Table 1: Descriptive Statistics

	GDPcap	Population growth	INV.	NetODA	Gexedu	Grsav
Mean	1.628	2.489	22.721	9.494	3.634	13.152
Maximum	140.371	8.118	115.102	94.946	44.334	83.287
Minimum	-47.503	-6.766	2.663	-.251	.055	-48.508
Std. Dev.	6.933	1.018	12.485	9.487	1.973	15.628
P1.	-13.918	-.37	4.685	.172	1.118	-16.712
P99.	17.499	4.395	65.896	49.842	10.092	60.182
Skewness	6.692	-1.863	1.844	2.674	8.258	.965
Kurtosis	137.323	16.033	10.157	15.396	150.074	5.06

Source: Author's computation

B. Empirical Results

The pooled data regression analysis' result using dummies (LSDV) of 43 countries also disclosed that the joint hypothesis of the dummies rejects the null hypothesis of the absence of joint effects of the countries. The tests listed above are the fundamental regression diagnostic tests for panel data. Aside from the absence of multicollinearity, the datasets are non-normal and

showed heteroscedasticity. These are all an indication of the inappropriateness of the application of pooled OLS methodology to estimate the data. Now, the data analysis methodology left is the fixed effect or the random effect.

Estimation Results

Fixed effects and random effects estimation of the model is as follows.

GDPcap	Coef.	Robust St.Err.	t-value	p-value	[95% Conf	Interval]
Popg	0.497	0.261	1.94	0.050	-0.005	0.999
INV	0.172	0.021	8.42	0.000	0.132	0.212
NetODA	0.099	0.029	-3.62	0.000	-0.154	0.246
Gexedu	0.134	0.113	-1.30	0.004	-0.336	0.068
Grsav	0.044	0.026	-2.20	0.028	-0.083	0.005
Constant	-1.509	0.932	-1.62	0.105	-3.333	0.314
R-squared		0.0758	Number of obs			1290
F-test		17.431	Prob > F			0.00000

Fixed effect estimation using Stata 17

GDPcap	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
Popg	0.4598	0.224	2.05	0.04	0.020	0.899
INV	0.1644	0.018	9.04	0.00	0.129	0.200
NetODA	0.0932	0.025	-3.69	0.00	-0.143	0.244
Gexedu	0.1168	0.099	-1.18	0.023	-0.311	0.3877
Grsav	0.0451	0.017	-2.85	0.004	-0.082	0.715
Constant	-1.306	0.885	-1.48	0.014	-3.041	0.428
R-squared		0.0765	Number of obs			1290
Wald Chi-square (5)		94.650	Prob > chi2			0.000

Random effect estimation using Stata 17

Apply the Hausman test to determine which model, a fixed or random effect, provides the best and most efficient estimate of the variables. The Hausman test has a p-value of less than 0.05 percent, indicating that the fixed effect model offers the best approximation of the model.

Hausman (1978) specification test

	Coef.
Chi-square test value	1.962
P-value	0.04

Hausman's test

Both models found that there is a positive relationship between population growth rate and GDP per capita growth rate. The remaining independent variables are likewise positively associated with the dependent variable. The fixed effect model's overall R^2 is close to 7.6 percent. The overall significance of the model, as shown by the *F-value (prob > F=0.0000)*, suggested that the model's overall predictive capacity appears to be good. The individual significance of the explanatory variables seemed to be adequate as well as shown here.

Table 2: Estimation results

Ind. Variables	**Dep. Var. (GDPcap)**	**Std. error**	**t-statistics**	**P-value**
Popg	0.497	0.256	1.94	0.05
INV	0.172	0.026	8.42	0.000
NetODA	0.099	0.028	-3.62	0.000
Gexedu	0.134	0.103	-1.30	0.004
Grsav	0.044	0.024	-2.20	0.028
Constant	-1.509	0.929	-1.62	0.105
R-squared - 0.0758				
The number of observations - 1290				
F-test - 17.431				
Prob > F - 0.00000				

Source: Author's computation

Table 2 shows that the coefficients of the fixed effect regression for all variables, including the primary variable, have the predicted sign and all are significant at 1% and 5% except for the constant term which is significant at 10%. The coefficient of population growth is 0.497 and it is statistically significant at 1 percent. Thus, the major variable (the population) of sub-Saharan African countries and their respective GDP per capita growth rate are positively correlated (a coefficient of 0.49) keeping other factors constant. The finding is consistent with those of previous studies such as Peter A. et al. (2018), Alemu K (2020), and others. Thus, the initial hypothesis of a negative effect of population growth on economic growth (as proxied by GDP per capita growth) may be rejected and accept the alternative hypothesis of the positive effect of a population.

Sub-Saharan African countries' investment rate also favorably affects the countries' GDP per capita growth rate and is found to be significant at 1%. As estimated in the model, a one-unit increase in the rate of investment leads to a 0.17 unit increase in GDP per capita growth rate keeping other factors constant.

Net official development assistance (NetODA) is positively related to the GDP per capita growth rate as well and is significant at 1%. Ceteris paribus, a one-unit increase in net official development assistance contributes to 0.1-unit growth to GDP per capita growth rate.

The government expenditure on education, the other control variable, is also positively related to the GDP per capita growth rate which is significant at 1 percent. A one-unit increase in educational expenditure of the government contributes to a 0.13 unit increase in GDP per capita growth rate keeping other factors unchanged.

At a 5% significance level, the association between gross saving and GDP per capita growth rate is determined to be positive. Keeping other factors constant, a one-unit increase in the gross saving of sub-Saharan African countries contribute to the 0.04 unit of the GDP per capita growth rate.

The findings of the analysis of population growth-economic growth relationship or linkage are consistent with a new report by the World Bank. According to a new World Bank document, '*Africa's Demographic Transition: Dividend or Disaster*?', Africa's sluggish fall in fertility rates would likely result in a fast-expanding young population, with the continent accounting for a substantially greater share of the global population. According to the report, current government measures and policies will determine the chance of boosting or realizing the possibility of harnessing the potential social and economic advantages of population expansion.

Among the document's suggestions are to capitalize on the demographic dividend by empowering girls and women through enhancing their health, knowledge, and abilities, as well as giving them more decision-making authority.

According to this report, changing demographics such as a rising population and a decrease in the number of dependent youths might have a significant influence on the economic growth of a country and families' welfare and overall health. It also warns that the population explosion witnessed in Africa today presents a difficult predicament if the respective governments failed to implement the appropriate and prudent policies, initiatives, and measures as soon as possible. Governments and public institutions in African countries have a major role in developing critical and realistic policy measures to turn the continent's expanding youth population into a significant economic force.

The World Bank estimates that Africa will become a major contributor to the global population by 2060 contributing 2.8 billion people of the 10 billion people of the world. The impact of the population explosion witnessed today on African countries could be different from country to country. The main deciding factor is how the countries act today with practical strategies and policies to transform the rising youth demography and the overall population into an educated, active, qualified workforce that can play an important role to realize sustainable economic development which can put an end to poverty in the region. Especially, the African countries should swiftly act to design strategies and broad-based programs focusing on the empowerment of women and girls and enable them to play a decisive role in the economy and use them as one major force to reap the demographic dividend. Otherwise, the potential for the youth population to divert to a force of destruction and chaos will be inevitable.

Conclusion

The study investigated the effect of population growth on GDP per capita growth rate in 43 countries in the sub-Saharan Africa region for the period 1990-2019. Although the Hausman test favored the FE model, both the FE and RE models revealed a positive relationship between GDP per capita growth and population growth. The finding confirms the population-driven economic growth theory, which holds that a country's population expansion fosters economic growth and development. The other variables, investment, net official development assistance (NetODA), government expenditure on education, and gross saving, positively and significantly affect the GDP per capita growth rate of the region.

The primary finding discussed above might have significant policy implications. According to the United Nations' World Population Prospects (2019), the working-age population (25 to 64 years) in most Sub-Saharan African countries is expanding faster than other age groups (from 35 percent in 2019 to 43 percent in 2050 and 50 percent in 2050). The report also stated that this condition can boost higher economic growth resulting from the demographic dividend. However, the countries must strengthen their economies by raising domestic investment and saving rates in order to support this massive growing workforce. Otherwise, as a result of unemployment, this massive workforce has the potential to become a destructive force. The sub-Saharan African countries also need to build their human capital and youth productivity by increasing educational expenditure.

The sub-Saharan African countries need to strongly develop and implement a policy of "education for all”. Furthermore, they also need to secure peace and stability in their respective countries to attract foreign investments and stimulate local investments.

Appendix

Before beginning the panel data analysis of the variables, it is critical to perform diagnostic tests on the variables to ensure normality, heteroscedasticity, autocorrelation, multicollinearity, and unit root. These tests are the basic classical linear regression assumptions conducted to decide the application of the OLS method.

The multicollinearity test is conducted using the variance inflation factor (vif) test. The (vif) of the independent variables are less than 10, indicating that there is no multicollinearity between the variables.

	VIF	1/VIF
Grsav	1.415	.707
NetODA	1.335	.749
INV	1.088	.919
Popg	1.077	.929
Gexedu	1.046	.956
Mean VIF	1.192	

Source: Author's computation

Similarly, the test for a heteroscedasticity test of the data on hand is indicated below. The p-value is less than 0.05, which is sufficient to reject the null hypothesis of constant variance. Thus, the data set on hand have heteroscedastic variances.

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of GDPcap
H0: Constant variance
chi2(1) = 1802.76
Prob > chi2 = 0.0000

The normality test on the residuals of the variables given below revealed that the p-value is 0 indicating that the data is non-normal.

Shapiro - Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
GDPcap	1,290	0.625	298.434	14.257	0.000
Popg	1,290	0.852	118.106	11.938	0.000
INV	1,290	0.883	93.371	11.350	0.000
NetODA	1,290	0.780	174.593	12.915	0.000
Gexedu	1,290	0.634	290.844	14.192	0.000
Grsav	1,290	0.927	58.379	10.175	0.000

Source: Author's computation

The Levin–Lin–Chu unit-root test was applied to determine the stationarity of the variables. The result confirmed that all the variables included are stationary. This is the basis for most data analysis and diagnostic tests of the data on hand.

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