



Is Sub-Saharan Africa likely to yield demographic dividends in the 21st century?

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ACRONYMS AND ABBREVIATIONS

| | |
|----------|--|
| ARDL | Autoregressive Distributed Lag |
| AU | African Union |
| COVID-19 | Coronavirus Disease 2019 |
| EA | East Africa |
| GCI | Global Competitiveness Index |
| GDP | Gross Domestic Product |
| GMM | Generalised Method of Moments |
| GNI | Gross National Income |
| HCI | Human Capital Index |
| HIV/AIDS | Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome |
| IMF | International Monetary Fund |
| MA | Middle Africa |
| PMG | Pool Mean Group |
| SA | Southern Africa |
| SDG | Sustainable Development Goals |
| SSA | Sub-Saharan Africa |
| STEM | Science Technology Engineering and Mathematics |
| TAI | Technology Advancement Index |
| UN | United Nations |
| UNCTAD | United Nations Conference on Trade and Development |
| UNESCO | The United Nations Educational, Scientific and Cultural Organisation |
| UNFPA | United Nations Population Fund |
| WA | West Africa |
| WGI | World Governance Indicator |
| WHO | World Health Organisation |

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ABSTRACT

Sub-Saharan Africa (SSA) has been undergoing an increase in population, which has seen the region grow from 0.55 billion people in 1990 to 1.17 billion in 2021. By 2100 it is estimated that SSA will be accounting for 35 percent of the global population – up from 14 percent in 2019. This increase in population will result in an increase of the working age population, which in turn presents an opportunity to yield demographic dividends. Demographic dividends occurs when there is a substantial increase in economic growth due to an increase in working age population. This dissertation examines the impact of the increase in (i) working age population (ii) female working age population on economic growth. In addition, the study also examines the impact of human capital and savings on economic growth, as they are co-determinants of demographic dividends. The study uses dynamic panel data from 40 countries within the region over a period of 2000 to 2018, using GDP per capita to represent economic growth while controlling for natural resources, rule of law, technology and trade openness. The Pooled Mean Group (PMG) and the two-step difference Generalised Method of Moments (GMM) were used to predict the relationship amongst the dependent and independent variables.

The main findings of the study using PMG estimation are that: (i) there is a negative statistically significant relationship amongst working age population, female working age population and GDP per capita, due to the unproductive labour impact and low income levels; (ii) there is a positive and statistically significant relationship amongst human capital (education and health) and GDP per capita; and (iii) savings has a positive and statistically significant relationship with GDP per capita, however the impact is minimal due to the high dependency ratio and the population still consuming a significant portion of their income. Further to the PMG estimation, the GMM estimation was applied on the panel data to evaluate the validity and robustness of the PMG empirical results. The GMM estimator observed a similar directional relationship as the PMG amongst the main variables. An analysis was also performed on sub-regional data, which showed similar observations to the macro results of SSA.

The empirical results from this study clearly highlight the significance of improving human capital in the region, as this will advance labour supply in terms of productivity, innovation and technological enhancements, which will have a positive impact on GDP per capita and increase the earning potential of the population. This will then become a catalyst for improved savings and wealth accumulation.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The United Nations (UN) has forecast that the Sub-Saharan Africa (SSA) will have the largest population in the globe in the 21st century. The region is expected to increase from 13.8 percent of the global population in 2019, to 21.8 percent in 2050. By 2100, SSA is expected to account for 34.7 percent of the globe's population. Globally, by 2050, it is estimated that the SSA population will account for 52 percent of the 2.0 billion increases in global population. This will result in SSA population increasing by an estimated 1.1 billion. As represented in Table 1 (Page 12), the region's population is predicted to increase by 254 percent by 2100, from 1.1 billion in 2019 to 3.8 billion by the end of year 2100. In most of the SSA countries, the working age (16 to 64 years) population group is increasing the fastest. The working age population in SSA is predicted to increase in the 21st century as a result of the overall increase in population; by 2050 and 2100 it is predicted to account for 43 percent and 50 percent respectively of the total globe's population (United Nation, 2019). The increase in population is expected in three of the sub-regions, namely Middle, Eastern and Western Africa. Southern Africa's population is expected to decline during this period due to lower fertility rates and the historic impact of the HIV/AIDS pandemic. In 2019, SSA had two countries in the top 20 most populated countries globally, however by 2050 the region will have four countries in the top 20. This significant increase in population will create an opportunity for the region to fast-track its economic development and potentially realise demographic dividend.

When such a change in demographic occurs, a window of opportunity arises as a country and/or region has the potential of yielding demographic dividends through the increased economic output from the working age population. For demographic dividends to be optimal it is required that: (i) the dependency ratio should be less than 60 percent within a country and/or region; and (ii) the fertility rate per female should be less than three children. There are three main determinants for demographic dividends, the first of which is increased labour supply, which will result from the change in demographics when there is a greater proportion of working age population within a country or region. The second, human capital levels, includes quality education and health. Quality education allows for innovation that will enhance technological levels, while quality healthcare is necessary to support the working age population, as this will

enhance prolonged productivity. Over the long term, good health increases life expectancy. Finally, savings from the population assist in contributing towards much needed capital investments, which are required by an economy in order to accelerate it. Demographic dividends materialise in two forms: (i) increased economic growth due to higher output generated by an increased working age population, this is the first dividend usually last for four to five decades; and (ii) as there is an increase in the economic output of the working age population coupled with a reduction in dependents, there are more resources available for saving to accumulate assets and maintain a standard of living at retirement time. This second dividend usually lasts longer and has a much higher impact on the economy than the first (Bloom et al., 2003).

Demographic dividends thus has the ability to generate conditions for sustainable economic development. In 2015, the international community, through the United Nations, implemented the Sustainable Development Goals (SDGs), with the objective to end poverty and ensure sustainable development worldwide through a unified approach to economic, social and environmental growth. The UN acknowledges that inclusive and sustainable growth will arise from complementary collaboration amongst the public and private sectors. There are 17 SDG goals, all of which have relevance to SSA given the region's socioeconomic challenges. Currently the region is trailing behind on all 17 goals, however, and the demographic estimates of the United Nations are highlighting additional challenges to sustainable development. The regions experiencing rapid population growth, most of which are in SSA, need to deliver quality schooling and healthcare in order to improve their human capital, which is critical for demographic dividends.

SSA has over the past decades experienced low productivity levels and sluggish competitiveness when compared to the rest of the globe. This has been caused by insufficient government policy implementation and marginal private sector growth. There has been a few exceptions, where some countries within the region having seen economic improvements that have enabled them to be more competitive. This has been achieved through enhancing macroeconomic strategies, improving health conditions, having open goods markets that are effective and creating credible institutions, all of which make a solid base for increasing economic opportunities that will create strong economies. SSA is the worst performing region in the globe economically. The main challenges are due to very limited investment in education and health, low economic investments from the private sector. These challenges have resulted

in the region receiving an insignificant proportion of available global investment funding, which is required to address the socioeconomic needs of the region. SSA's GDP per capita in 2021 was \$1,645 whilst the world average was \$12,263, i.e., SSA was 87 percent below the average world GDP (World Bank, 2022). There are 28 low-income countries globally, 25 of which are in SSA (World Bank, 2022). This means that almost half of the countries in SSA are defined as low income. These economies have a per capita gross national income (GNI) not greater than \$1,026. With the expected increase in population in SSA, it has become even more important that policies and activities are put in place to enable the improvement in economic output for the population of the region. SSA also needs to be well prepared through policies and activities for the unprecedented increase in working age population that will continue throughout the century.

The objective of this research was to assess the effectiveness of economic activities within SSA and its sub-regions in light of the growing population. The region is experiencing demographic transition which presents a limited window of opportunity for significant economic gains to put us on par with the rest of the world, to potentially surpass some economies, and to be able to provide sustainable economic development for the region and its people, thereby meeting the African Union Agenda 2063.

1.2 RESEARCH PROBLEM AND QUESTIONS

The study sought to examine the following:

- a. With the SSA population increasing well into 2100 resulting in an increase labour supply, is SSA likely to achieve demographic dividends through its working age population and its female working age population?
- b. Are the region's savings and human capital creating economic growth, thereby enabling demographic dividends?

To yield demographic dividends, three main factors must have an impact: (i) labour supply; (ii) human capital; and (iii) savings.

(i) Labour supply

Labour supply increases where there is a higher percentage of the population being of working age and there is an increase in women entering the workforce and becoming economically active.

SSA growing working age population.

The population in SSA is anticipated to increase from 1.1 billion to 2.1 billion from 2019 to 2050 by 2100 it is estimated to be 3.8 billion (United Nations, 2019). The Middle, Eastern and Western regions within SSA are all expected to increase in population size, while Southern Africa is the exception with a decline in population being forecasted. The increase in population by 2100 is projected to result in the largest part of the population being between the ages of 16 and 64. SSA is currently the region with the youngest population in the world; based on 2020 data from the United Nations, 60 percent of the population (800 million) is below the age of 25, while 50 percent of the population (677 million) is between the ages of 3 and 24. By 2030, SSA will account for 28 percent of the global population aged from 3 to 24, compared to 17 percent in 2000 and 25 percent in 2020. This population growth presents both a risk and an opportunity for the region.

Per the World Bank (2021), SSA's current unemployment rate is 7.7 percent, while the rest of the globe's is 6.2 percent. The region's unemployment numbers have been increasing since 2007, whilst the global rate has been on the decline, with exception of 2020 and 2021 due to the COVID-19 pandemic. SSA has two extremes relating to unemployment, with South Africa and Eswatini having the highest unemployment rates of 33.6 percent and 25.8 percent respectively, while Niger has the lowest unemployment rate in the region of 0.8 percent. Should the current unemployment trend for SSA continue into the future, the region is heading for a population crisis if a substantial amount of the working age population remains unemployed. High levels of unemployment create a serious challenge for yielding demographic dividends as the increased labour supply is unable to contribute positively to increasing per capita income. Decent formal employment is thus required, which enables increased economic activity which then allows for resources to be distributed towards good quality education and healthcare. This demographic transition results in females having fewer children. With fewer children per female allows for females to begin entering the formal workforce. All these factors combined

allow for increased family income and therefore increasing potential to savings (Bloom et al. 2009).

Females entering the workforce

The health of females is partially enhanced by having fewer children, while having less children also frees up time to allow females to enter the formal workforce. Participating in the labour market creates an environment that facilitates an increase in the independence and social status of females. When a woman participates in the labour force, it enables her to financially contribute towards her family and her community, creating an opportunity for improved education and therefore increased productivity in the labour force. This growth in productivity results in increased income and resources available to the family (Crespo Cuaresma et al. 2007; Bloom et al. 2009). In the SSA region, there are still significant disparities in labour participation rates between males and females, despite the population ratio being almost 50:50. The male labour participation rate has ranged between 73 percent and 76 percent over the last two decades, but for females it has ranged between 61 percent and 63 percent.

(ii) Human Capital

Human capital is measured by the quality of health and education in the population. Part of demographic transition starts when a country's mortality rate decreases due to enhancements in healthcare, which then results in an increase in life expectancy. An increase in life expectancy significantly alters the way the population makes life decisions, such as (i) investment in education; (ii) investments towards the needs of the family; (iii) saving for retirement; and (iv) the role of females at home and in society at large. As people live longer and have reduced number of children, they tend to invest in their children's education to more advanced levels. This has a positive impact on the health of the children, which improves their cognitive development (Jamison et al. 1996). The impact of this is that the educational investment, coupled with quality of health, results in more productive labour force, increased salaries and improved quality of life for the population at large (International Labour Office, 1996).

Quality of education

The SSA population is not only young but is also growing rapidly. This young population can be a catalyst and engine for economic development and growth if they are provided with the necessary skills and competencies through education. Idrees and Siddiqi (2013) observed that education spending has a positive correlation with economic growth; developed countries have progressed further compared to developing countries as they have made significant investments in education, creating an environment for innovation and technological improvements. Education is one of the most effective investments in fighting poverty and assisting with socioeconomic development, as it equips and enables a population to move from surviving to thriving. Education also limits the transmission of poverty from one generation to the next by providing increased opportunities to earn an income, as well as by assisting the population to move other socioeconomic indicators in a positive direction. Barro (1991) concluded that education used as a measure for human capital development is the main determinant for economic development and growth. Benhabib et al. (1994), meanwhile, argued that an improvement in per capita income is significantly dependent on a country's standard of education. Gemmell (1996) noted that the different levels of education and their associated growth rates are critical in understanding economic growth, while Gylfason et al. (2003) suggested that education reduces inequalities and positively impacts growth within an economy.

As depicted in Table 3, the region scored 44.3 out of 100 for skills under the human capital pillar (World Economic Forum, 2019), which was the lowest score in the world. The SSA region also has the highest rate of education exclusion. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has estimated that in SSA, over 19 percent (32 million) of children between the ages of 6 and 11 are not in school; (ii) over 37 percent (28 million) between the ages of 12 and 14 are out of school; (ii) and almost 60 percent (37 million) of youth between the ages of 15 and 17 are not in school (UNESCO, 2019). There is a direct link between being a low-income region and having high out-of-school rates due to socioeconomic factors that impact access to education. This is a serious challenge considering that the school age population in the region is estimated to increase in the decades to come; one in two Africans will be under 25 years of age and the region will be home to one billion children and adolescents aged 0 to 18 by 2050.

The skills rating is determined by education level, which looks at the average number of schooling years of the population. The SSA region has an average of 8 years compared to 12 years globally. SSA's primary education also has a pupil to teacher ratio ranging from 30 to 37, whilst the rest of the globe is 15 to 19 (World Economic Forum, 2019). This has a negative impact on the working age population as it impacts the level of training for employees, the level of professional training, the skill sets that graduates can obtain, and ease of sourcing skilled employees.

Good health

Life expectancy in literature has been used as a measure for good health, (Bloom et al. 2000; 2003) noted that life expectancy has a positive and significant impact on a region's economic growth rate. In addition, health has been determined to be a key element of economic growth model (Carrion I-Silvestre, 2005; McCoskey, 1998; Narayan, 2006). Bloom et al. (2003) argued that human capital proxy being health has a direct influence on the productivity of a labour force and therefore the burden of illness on an economy. A healthy labour force that is physically and mentally sound are more enthusiastic and robust at work, and as a result are more productive. As a consequence of this they are likely to earn better salaries. This labour force is also less likely to be sickly, resulting in more time spent at work (Bloom et al. 2004). The Commission on Macroeconomics and Health of the World Health Organisation (2002) observed that an improvement in health results in increased economic growth and therefore reduces poverty in a population. Through the study by Bloom et al. (2003), it was found that each year of improvement in life expectancy adds an additional 4 percent to economic growth. In order to create demographic dividends, effective health policies must thus be implemented. The improvement of health and health infrastructure includes: (i) providing good quality healthcare to infants; (ii) providing females with access to reproductive health facilities; (iii) reducing illness; and (iv) supporting children's health requirements in order to maximize their educational achievements.

Per Table 3, SSA scored 50.8 out of 100 for health in the human capital pillar (World Economic Forum, 2019). There has been an improvement resulting in an increase year on year in life expectancy and a decline in death of infants which are reflective of the healthcare policies that have been implemented in the region, however SSA's life expectancy is still the lowest in the

globe. The UN has estimated that in 2021, the average world life expectancy was 71, while SSA's life expectancy was 59.7. This is up from the 1990 estimate of 49.2.

The decline in child mortality has had a direct impact on people's decisions to have fewer children, as the risk of death during childhood has reduced. An increase in human capital has a positive impact on parents having the ability to make investments in their children. Parents have to make investment decisions, including investing in education of their children, which has the ability to increase their earning potential. Due to education being an expensive investment, it is more manageable when there are fewer children. Fewer children will also inevitably result in more educated women, as there will be less discrimination when it comes to the allocation of resources within each family. Families become smaller as women will not only want to spend their time on bearing and raising children (Birdsall et al. 2001), but also on participating in economic activities.

(iii) Savings

In any population, the age group between 16 and 64 is most likely to earn an income and therefore should have a portion of their resources available for savings. An increase in savings results in an increase in both personal and nationwide savings. The impact of savings on the economy is much larger when the working age population is born during high fertility periods, therefore increased pool of that age group. This generation of individuals therefore move into their middle ages needing to provide less support to their children as they become independent. An increase in savings also contributes towards industrial investments which improves economic growth (Crespo Cuaresma et al. 2007). With parents feeling less strain to support their children, household income can be concentrated on providing quality food, education and healthcare for the family, including girls. With improved health and increased life expectancy, there is more motivation for adults to increase their savings as they plan to sustain their standard of living for the years of retirement ahead of them (Lee et al. 2000). SSA's gross savings as a percentage of GDP was 18.7 percent in 2019, compared to 25 percent for the rest of the world.

1.3 RESEARCH OBJECTIVES AND HYPOTHESES

1.3.1 Research objectives

The study's main objectives were to examine whether SSA is likely to start to yield demographic dividends:

- (i) To examine the effect of increasing labour supply through the working age population and the female working age population on SSA's economic growth.
- (ii) To investigate the impact of human capital and savings on economic growth in SSA.

1.3.2 Research hypotheses

The following research hypotheses were established to respond to the research questions and address the research objectives in relation to SSA and its sub-regions:

Hypothesis 1: There is a positive relationship between labour supply (working age population and female working age population) and economic growth.

Hypothesis 2: There is a positive relationship between savings and human capital and economic growth.

1.4 SCOPE AND JUSTIFICATION OF THE STUDY

As the total population and the working age population in SSA increases, the big question is whether SSA is positioned to yield demographic dividends from this. Numerous studies have been conducted on demographic dividends in Asia and Europe, however very limited quantitative research has been undertaken on the SSA region. Bloom et al. (2017) published a study that cautioned that detailed policies must be implemented if the region is to benefit from demographic dividends before the window of opportunity closes. Prior to this, Mason (2005) examined demographic dividends globally, however this was not specific to SSA therefore the findings were very high level. As a result of the lack of quantitative literature on SSA's potential to yield demographic dividends, this research examined the extent of demographic dividends in SSA so far.

The observations of this study will be important for governments and policy makers within the region, including those in regional bodies such as the African Union. The study will provide insights into the extent of demographic dividends for the region, which may have an impact on the progress of the UN SDGs, particularly 1, 2, 3, 4, 5, 8 and 10, and the African Union's Agenda 2063, specifically 1, 2, 3, 4, 17 and 18, as they are closely linked to demographic dividends which results from improved economic outputs. This study will also provide policy recommendations that can be used to formulate favourable regulations and policies that will increase the likelihood of yielding demographic dividends.

1.5 ORGANISATION OF THE STUDY

This research consists of five chapters:

Chapter 1 serves as an introduction to the study, providing a background and an overview of demographic dividends and their determinants. This chapter also outlines the research problem and sets out the motivation and justification for undertaking the research.

Chapter 2 details the theoretical foundation for the concept of demographic dividends, as well as an empirical literature review.

Chapter 3 discusses the methodology and research tools used in the study.

Chapter 4 presents and discusses the results of the study regarding whether or not the region is yielding demographic dividends.

Chapter 5 outlines the study's key findings and conclusions, before offering policy recommendations for the acceleration of demographic dividends.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter assesses the critical empirical literature that is fundamental to the discussion on demographic dividends. Additionally, it provides an overview of the economic and social standing of SSA in relation to the world and its impact on, and ability to yield demographic dividends.

2.2 DEFINITION OF CONCEPT: DEMOGRAPHIC DIVIDENDS

The United Nations Population Fund (UNFPA) stated that demographic dividends occur when an economy sees a significant improvement in income per capita due to an increase in the working age population. Demographic dividends come in two forms – dividends from demographic transitions and an accumulation of assets through investments. The first dividend results from demographic transition, i.e., when there is an increase in population, with a larger proportion being an increase in the working age population (ages 16-64), this allows for a decrease in the dependence ratio of a country. Improved healthcare, a lower mortality rate, increased life expectancy and a lower fertility rate leads to a demographic transition. During a demographic transition the labour force temporarily increases much faster than the number of dependents, creating an opportunity for resources to be invested for economic development while supporting the family requirements. All other factors being equal, there will be a rapid increase in per capita income and the first dividend is realised. The first dividend is usually for four to five decades or more, before the lower fertility rate reduces the size of the labour force. Mason (2005) estimated that SSA's first dividend began in 1998 and will last until approximately 2048, as depicted in Annexure 2.

The second dividend arises from increased life expectancy; as the population lives longer and has fewer dependents, the working age population is able to save up for retirement and accumulate assets. This results in an improvement in the national income, which contributes to sustainable development. Mason (2005) concluded that the second dividend is much greater than the first, at almost twice the rate. The demographic transition does not guarantee that the region will yield a demographic dividend, however it is a window of opportunity to increase the economic output of the region. The dividends require effective policy implementation for there to be an improvement in the quality of life of the population.

2.3 OVERVIEW OF THE SUB-SAHARAN AFRICA POPULATION AND ECONOMIC DEVELOPMENT

Over the past 30 years, SSA’s population has almost doubled, increasing from 0.55 billion to 1.17 billion from 1990 to 2021. The region’s growth in population is resulting from the improvement in healthcare and a decline in mortality. There has been a notable decrease in child mortality, with the region experiencing a decline from 107 deaths for every 1,000 in 1990, to 50 deaths for every 1,000 in 2020. The fertility rate has also reduced to under 4.6 children per woman in 2020, from 6.3 children in 1990. In 2020, the level of fertility globally was 2.4 live births per female. As previously noted, just over 60 percent of the SSA population is below the age of 25. In most of SSA, the age group between 16 and 64 years is increasing more rapidly than any other age group (United Nations, 2019). Figure 1 shows a spike in the working age population from 1990, which is estimated to peak between 2020 and 2070.

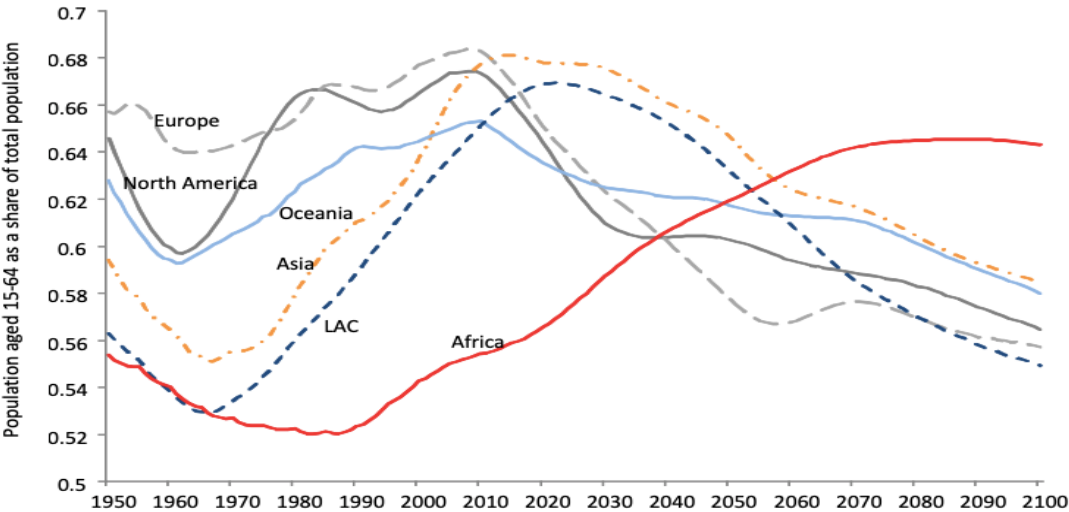
SSA is projected to become the most populous of the eight geographical regions in the world, accounting from 14 percent in 2019 to 35 percent in 2100. Of an estimated increase of 2.0 billion people worldwide between 2019 and 2050, 1.05 billion is projected to be in Sub-Saharan Africa. Table 1 depicts that by 2100, the regional population will increase by 254 percent from 1.1 billion to 3.8 billion. In 2000, SSA only had two countries (Nigeria and Ethiopia) in the 20 most populated countries in the world, however by 2050 it is estimated that this will be four countries (Nigeria, Ethiopia, DRC, and Uganda). The sub-regions that are estimated to significantly increase in population in SSA are Eastern, Middle and Western Africa; their proportion of the region’s population will increase from 72 percent in 2000 to 80 percent by 2050. Southern Africa is the smallest of the sub-regions, with a population that is expected to decrease by 8 percent due to a decline in fertility and epidemics such as HIV/AIDS.

Table 1: Population of the world by SDG region (2019-2100)

| | Population (billions) | | | |
|----------------------------------|-----------------------|-------------|-------------|--------------|
| | 2019 | 2030 | 2050 | 2100 |
| World | 7,71 | 8,55 | 9,74 | 10,88 |
| Eastern and South-Eastern Asia | 2,34 | 2,43 | 2,41 | 1,97 |
| Central and Southern Asia | 1,99 | 2,23 | 2,50 | 2,33 |
| Europe and Northern America | 1,11 | 1,13 | 1,14 | 1,12 |
| Sub-Saharan Africa | 1,07 | 1,40 | 2,12 | 3,78 |
| Latin America and the Caribbean | 0,65 | 0,71 | 0,76 | 0,68 |
| Northern Africa and Western Asia | 0,52 | 0,61 | 0,75 | 0,92 |
| Australia/New Zealand | 0,03 | 0,03 | 0,04 | 0,05 |
| Oceania | 0,01 | 0,02 | 0,02 | 0,03 |

Source: United Nations (2019)

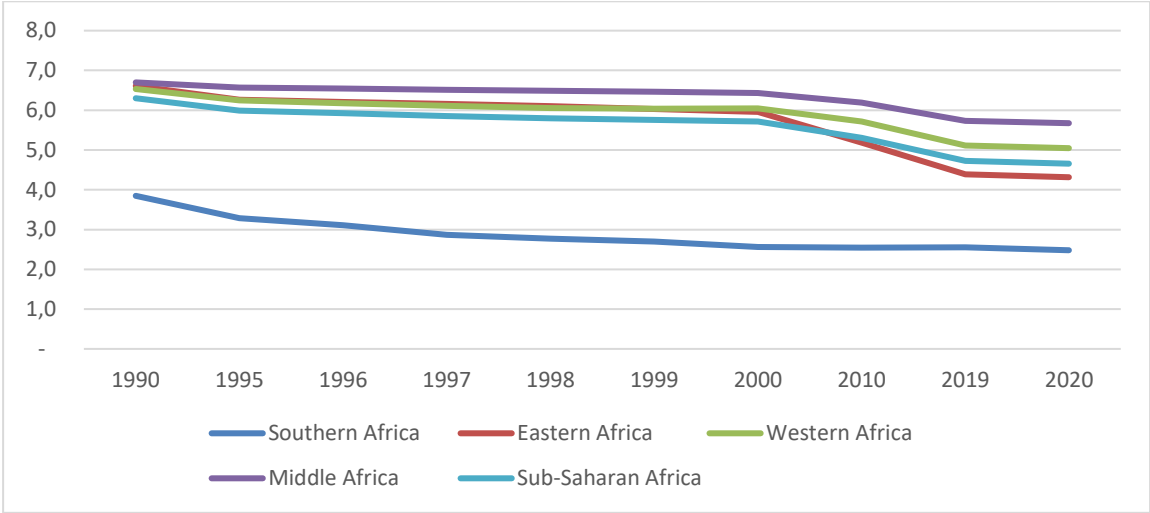
Figure 1: Global trends in the working population (1950-2100)



Source: International Momentary Fund (2014)

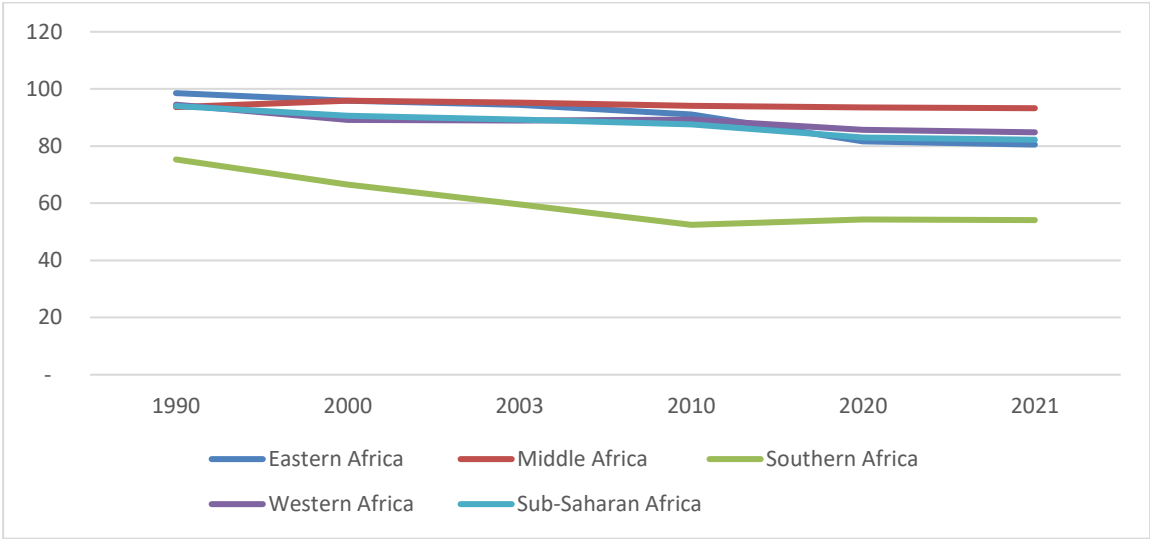
The decline in fertility in SSA has been moderate, and coupled with the decline in mortality rate, the region’s population is estimated to grow rapidly. The United Nations (2004) has defined the demographic dividends window as occurring when female fertility decreases to less than three children per woman and the dependency ratio decreases to less than 60 percent. Further, the window of opportunity to yield dividends occurs when the percentage of the population that is under 15 reduces to less than 30 percent and the percentage of people 65 years and older is reduced to below 15 percent. As per Figure 2, only Southern Africa has had a fertility rate of less than three children per female since 1997. Further, there is still a challenge with the region’s dependency rate, which was at 82 percent in 2020 (see Figure 3). Again, only Southern Africa has had a reduced dependency rate to less than 60 percent since 2003. Based on the above, it would appear that only Southern Africa has a window of opportunity open.

Figure 2: Sub-Saharan Africa fertility rates



Source: United Nations (2020)

Figure 3: Sub-Saharan Africa dependency ratios



Source: United Nations (2020)

Based on the projected population in Table 1, the least developed regions in the world will have the most significant increases in population. These regions consist largely of countries that have per capita gross national income (GNI) of less than \$1,026. These 28 countries are all in SSA, with the exception of Nepal, Afghanistan and Haiti (World Bank, 2020). In SSA there are 25 low income, 16 lower middle income, six upper middle and only one high income country, being Seychelles. Low-income countries are associated with being underdeveloped and are challenged by multiple socioeconomic issues. These countries typically receive external

financial and economic assistance for the purposes of expansion in order to enhance their economies to address socioeconomic challenges. The aid is either provided to governments or agencies with the aim of improving the economic standings of these countries. The aid is either offered as bilateral aid, which is provided directly to the benefactor country, or as multilateral aid, which is provided to global organisations that then issue funds to the countries. Low income countries are constantly confronted with the challenges associated with weak economies. The challenges of these countries include poor quality healthcare, which is associated with below average life expectancy, above average infant mortality, poor quality of education and inadequate infrastructure. Poor infrastructure results in a lack of adequate sanitation and clean water, thus the population suffers from high rates of illness and infections, a lack of nutrition and limited access to quality healthcare. These challenges are a result of limited investment in education and healthcare, particularly for marginalised people within the population. When there is inequality of income amongst a population there are multiple implications, such as high poverty levels, continuously decreasing economic growth and an increase in debt within households.

The World Bank launched the Human Capital Index (HCI) in 2010, which measures the productivity of future cohorts of workers based on the current education and health status of each country and region. The sobering reality is that an average child will only realise 56 percent of their productivity as the next generation of workers globally. These results are even more disheartening for the SSA region, with a score of 40 percent. The HCI metric is measured ranging from 0 to 1.0, with the country ranking for 2020 ranging from 0.29 being the lowest score to 0.80 being the highest. The average world score was 0.56 (World Bank, 2020). Further to the region having the lowest overall score of 0.4, SAA has 24 of the 25 lowest scoring countries in the world. As depicted in Table 2 (Page 16), SSA trails behind on all indicators, with the largest gap being in component 2: schooling. Human capital is very important to society and the economy as it enables the population to realise its potential as productive members within a country or region. The higher the level of human capital the higher people's earnings, therefore it is an important driver of reducing poverty and improving the sustainable growth needed to achieve the SDGs and the AU Agenda 2063.

SSA also has the lowest score under the survival indicator, however this is least gap in relation to other regions. This small gap has been achieved due to the region seeing significant improvements in the survival rates of children, therefore decline in mortality rate of children.

The second indicator relating to schooling is of great concern, as the average child in SSA will receive 8.3 years of schooling, whilst a child elsewhere in the world will receive 10.8 to 13.3 years of schooling. The quality of education is measured through a harmonised test score, with North America scoring the highest and SSA scoring the lowest at 374. Due to the lower quality of education in SSA, the learning adjusted years of schooling is 5 years compared to the average of 7.8 globally (UNESCO, 2021). This effectively means that the average child in SSA receives five years of quality schooling based on the global education quality standards. UNESCO (2021) found that SSA requires in excess of 15 million teachers in order for its children to receive a quality education. The current ratio of pupils to trained teachers is 1:58 at the primary school level and 1:43 at the secondary school level. This has a direct negative impact on learners receiving less individualised learning experience and have far less direct contact with their teachers. The region is also experiencing a significant issue with teacher quality; in 2000, 84 percent had the minimum qualifications required to be primary school teachers, however due to high enrolment, by 2019 this has dropped to 65 percent. With the estimated increase in the young population, this presents a significant challenge for the region. Both the quality and quantity of the education system is very important, as education is the catalyst for innovation and technological advancements, which are needed for changing the trajectory of economic performance.

Table 2: Human Capital Index (2020)

| Indicator | East Asia & Pacific | Europe & Central Asia | Latin America & Caribbean | Middle East & North Africa | North America | South Asia | Sub-Saharan Africa |
|----------------------------------|---------------------|-----------------------|---------------------------|----------------------------|---------------|-------------|--------------------|
| <i>HCI Component 1: Survival</i> | | | | | | | |
| Probability of survival at age 5 | 0.98 | 0.99 | 0.98 | 0.98 | 0.99 | 0.96 | 0.93 |
| <i>HCI Component 2: School</i> | | | | | | | |
| Expected Years of School | 11.9 | 13.1 | 12.1 | 11.6 | 13.3 | 10.8 | 8.3 |
| Harmonised Test Score | 432 | 479 | 405 | 407 | 523 | 374 | 374 |
| <i>HCI Component 3: Health</i> | | | | | | | |
| Survival Rate from age 15-60 | 0.86 | 0.90 | 0.86 | 0.91 | 0.91 | 0.84 | 0.74 |
| Children under 5 not stunted | 0.76 | 0.90 | 0.85 | 0.82 | - | 0.69 | 0.69 |
| Human Capital Index 2020 | 0.59 | 0.69 | 0.56 | 0.57 | 0.75 | 0.48 | 0.40 |

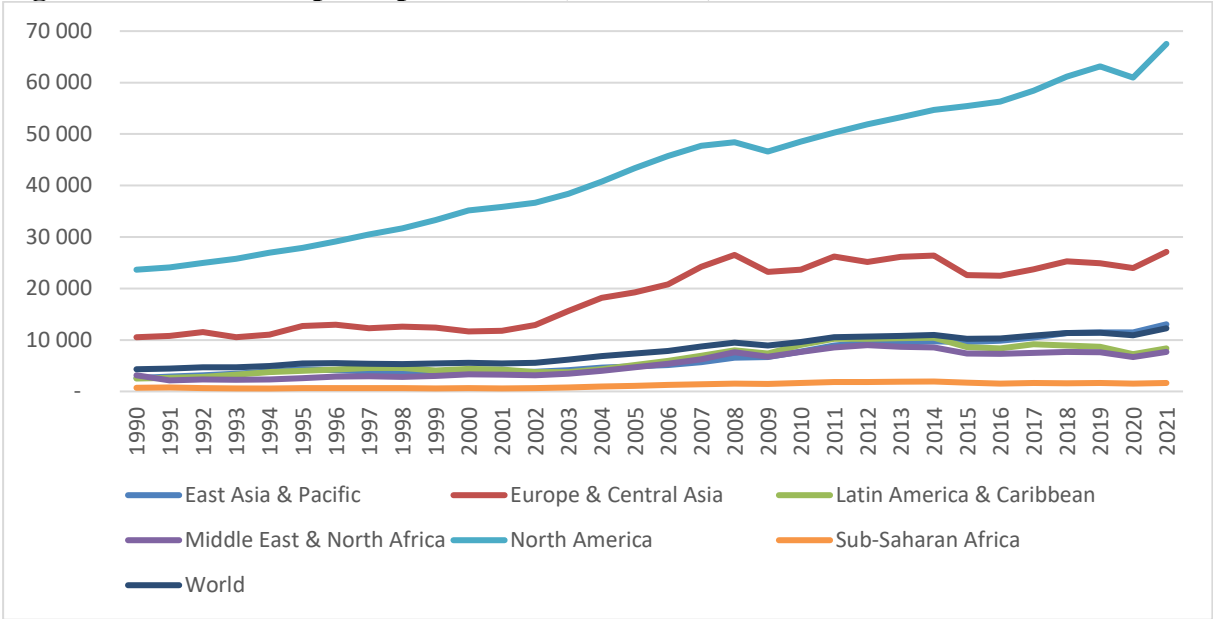
Source: World Bank (2020)

The third indicator is particularly alarming in that there is still a high mortality rate (36 percent) for the age group of 15 to 60 years. This population falls within the working age group that is required for economic advancement. This highlights a serious challenge as a significant number of the population will die prior to retirement, creating a gap in the benefit that the economy can potentially receive from the working age population.

Economic performance globally is determined by GDP, which is an economic measure of income and output for a particular period generated by a country or region. In a given period, GDP determines the market value of all the finished goods and services produced. The assessment also includes the total of value added at every phase of production (the intermediary stages) of all final goods created within a country. SSA has one of the lowest GDP rates in relation to the rest of the world. Per the World Bank (2019) the region’s GDP was 2 percent of global GDP, which has remained the same post-COVID.

SSA’s GDP per capita has remained fairly flat since 2015, averaging at \$1,600 compared to the world average of \$11,500. As depicted in Figure 4, there have been great gains in emerging and developing countries in Europe, East Asia, and the Pacific, resulting in ongoing disparities with SSA.

Figure 4: Global GDP per capita in US\$ (1990-2021)



Source: World Bank (2021)

Economic growth in some of the emerging and developing economies remains too stagnant to considerably decrease the gap with the developed regions. Income inequalities also continue to rise, as do inequalities in social measures and access to opportunity. Due to the current socioeconomic state of SSA, the SDGs are of more importance to the region than to any other.

In 2019, the UN issued the World Population Prospects, which provided estimates of the world population. These population projections raise a flag about future challenges of sustainable development for the region, as an even greater amount of resources are going to be required.

With the rapid growth in population, increased schooling and healthcare for the young population will be necessary to enable the creation of decent employment opportunities.

Before the COVID-19 outbreak globally, SSA was projected to have a 3.2 percent GDP growth rate in 2019, which would increase to 3.6 percent by 2020. These low GDP growth estimates were due to a difficult external environment, with continuous output interruptions in the countries that export oil and very low expansion in South Africa. As a result of the outbreak of COVID-19, a revised outlook was issued in April 2020 by the World Bank, which forecast negative growth ranging between -2.1 percent and -5.1 percent that would put the region into its first recession in over two decades. The region's final GDP growth numbers reflected -2 percent, which correlated with the world GDP growth decline of -3.3 percent for 2020. COVID-19 infections were low for SSA relative to the world, however the measures taken by governments across the region to contain infection levels had a negative influence on the economy as business operations were periodically halted, resulting in decreases in productivity. These measures negatively impacted about thirty million people, who were driven into extreme poverty. Approximately 22 million jobs were lost during the pandemic (African Union, 2022). In 2021 the region reported a 4 percent growth in GDP, as economies resumed trading and COVID-19 regulations were eased. In 2022, SSA's economy is forecast to only increase by 3 percent due to the indirect impact of the Russian invasion of Ukraine on commodity prices, fuel costs, food prices and headline inflation.

Numerous studies have shown that to reduce poverty and improve people's quality of life, sustainable economic development is needed. For regions such as SSA, which is characterised by being underdeveloped, economic development and growth are critical for enhanced education and increased access to quality healthcare and nutrition. With the target date for the SDGs being 2030, SSA is lagging on all 17 goals. In particular, the 8th goal (decent work and economic development) has not been achieved. Prior to COVID-19 there had been an improvement in goal 1 (reduction in extreme poverty), however there has been a reversal of these gains. Hunger has also increased again due to COVID-19, impacting at least 11 percent of the global population. The 'zero hunger' goal will therefore not be met by 2030.

The innovation stage in any country's economic development is critical, as it sees people rapidly adjusting to new technologies. This allows for global competitiveness, which is associated with becoming a high-income country. At the basic level of development, a government's key role is to provide macroeconomic stability, political stability and a free

market that enables the effective use of the country's primary commodities and labour by global investors and local corporations. Jeffrey Sach's Growth Development Index was introduced to provide rankings on levels of macroeconomics across the globe. The basis for the Index was the Porter's Business Competitiveness Index. The Index was later replaced by the Growth Competitiveness Index (GCI), which was introduced by Porter et al. (2004). The GCI incorporates micro and macro elements of competitiveness and is utilised by the World Economic Forum to evaluate individual country competitiveness.

The 2019 GCI report reviewed 141 economies to measure each country's competitiveness. Singapore was highlighted as the leading country in this respect, coming out top in health, infrastructure, financial systems and functioning of the labour market. Sub-Saharan Africa had the lowest score of 46.3, with scoring of each pillar detailed in Table 3 . In total, 34 countries in SSA were included in the GCI assessment, with the highest ranked being Mauritius at 52 and South Africa at 60. Per the report, 80 percent of SSA economies are in the lower half, with 26 economies being included in the bottom 30 globally in respect of domestic and foreign competitiveness.

As noted by business leaders, economists and policymakers, SSA's slow pace of improvement in productivity and competitiveness is the main reason the continent is unable to provide increased employment opportunities to its population. The main competitiveness challenges are the significant gap in infrastructure, the slow pace of uptake of latest technologies and significant skill mismatches. These challenges have been identified as the main issues preventing Sub-Saharan Africa from having an ecosystem that allows for improvement in employment rates and free enterprise prospects for the populace.

Table 3: Global Competitiveness Index (GCI) 4.0 by region

| | Enabling Environment | | | | Human Capital | | Markets | | | | Innovation Ecosystem | |
|-------------------------------------|----------------------|----------------|--------------|--------------------------|---------------|--------|----------------|---------------|-------------------|-------------|----------------------|---------------------|
| | Institutions | Infrastructure | ICT adoption | Macro-economic stability | Health | Skills | Product Market | Labour Market | Financial systems | Market size | Business dynamism | Innovation Capacity |
| East Asia and the Pacific | 61.6 | 74.8 | 70.3 | 89.6 | 83.8 | 67.3 | 62.2 | 66.6 | 74.3 | 67.9 | 66.1 | 54.0 |
| Eurasia | 53.8 | 67.7 | 59.5 | 74.9 | 71.3 | 66.1 | 56.1 | 63.5 | 52.0 | 50.3 | 61.9 | 35.5 |
| Europe and North America | 64.7 | 79.7 | 70.4 | 92.6 | 89.1 | 74.6 | 60.0 | 66.4 | 70.9 | 60.1 | 68.3 | 58.1 |
| Latin America and Caribbean | 47.1 | 61.3 | 50.9 | 73.7 | 82.2 | 58.7 | 51.6 | 55.9 | 60.3 | 51.2 | 53.8 | 34.3 |
| Middle East and North Africa | 55.5 | 70.5 | 57.6 | 75.3 | 80.8 | 62.9 | 56.7 | 54.8 | 63.7 | 59.9 | 58.2 | 41.3 |
| South Asia | 50.0 | 59.2 | 35.1 | 74.7 | 68.4 | 50.1 | 45.8 | 51.5 | 60.0 | 67.7 | 57.8 | 36.3 |
| Sub-Saharan Africa | 46.9 | 45.0 | 34.3 | 69.4 | 50.8 | 44.3 | 49.3 | 54.6 | 50.8 | 40.4 | 51.8 | 29.4 |

Source: World Economic Forum (2019)

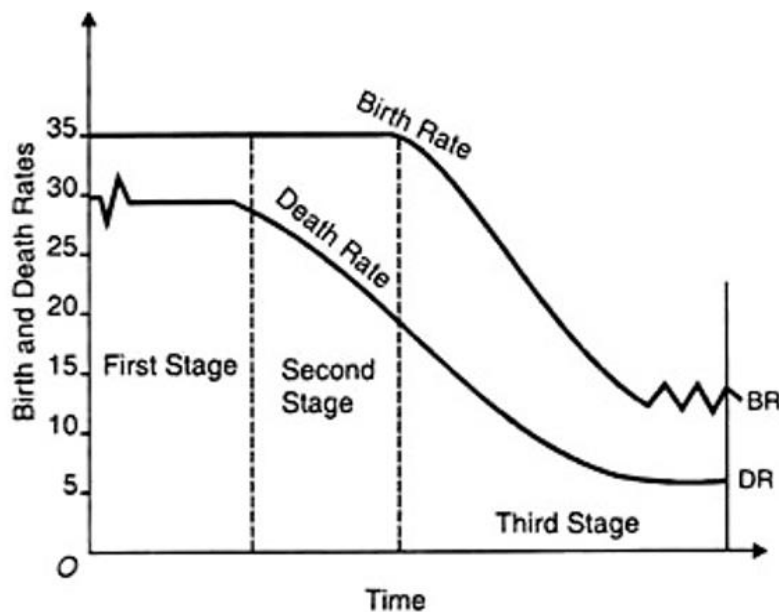
2.4 THEORY AND CONCEPTUAL FRAMEWORK

The theory and conceptual framework for demographic dividends is supported by the theory of demographic transition, which details the changes in population trends, as well as the unified growth method, which details the changes in economics factoring changes in population.

2.4.1 Theory of demographic transition

The theory of demographic transition is predicated on changes in the population of a country and/or region. The theory details that every country experiences three different phases of population growth: (i) a period of high birth and death rates, where the growth rate is low; (ii) a stable birth rate and a fast declining mortality rate, causing a quick increase in the population; and (iii) a transition period where the birth rate begins to decline to mirror the mortality rate, moderating the growth rate (Bloom et al. 2009). Looking at Figure 5, SSA has past the first stage and is currently in the second stage as the region is experiencing fast increase in population and mortality has been on the decline and was at 50 deaths for every 1,000 births in 2020 (World Bank, 2021).

Figure 5: Population change over time



Source: Bloom et al. (2009)

In the first phase, the population largely resides in rural areas and agriculture is the main source of employment. There are a few small-scale consumer goods industries and an underdeveloped services sector that provides banking, commerce, insurance, and transportation. Poverty is rife due to low-income levels. In order to supplement household incomes, it is deemed necessary to have large families, i.e., children are seen as “insurance” for old age. There is also high level of illiteracy, and the population is superstitious and does not support birth control. Due to inadequate health facilities and poor nutrition, the mortality rate is also high. The most vulnerable people in the population are females of childbearing age and young children. This is the phase that SSA has largely come out of.

In the second phase a country sees economic growth, with industrial productivity rising and agriculture and transportation improving. There is also increased labour activity and higher earnings, which leads to better nutrition and healthcare. The combination of these factors results in a reduced death rate and stable birth rates. The population at this point is not inclined to having fewer children, as when the children grow and begin to work they will add to the household earnings. With improved quality of life, life expectancy also tends to improve. In SSA, life expectancy increased from 49 years in 1990 to 60 in 2020 (United Nations, 2020). This population increase is creating a window of opportunity for demographic dividends.

In the third and final phase, the population growth rate begins to decline as the fertility and death rates start to equal each other. The populations move from subsistence living to an improved quality of life as earnings increase. The economic growth sectors also improve due to the increased economic output and transformation in technology. Education levels also improve, encouraging the discipline to think and innovate. The population opts to get married older and starts having fewer children as the need to supplement household earnings decreases. The population actively adopts family planning tools as it becomes inconvenient and costly to have a large number of children. These attributes tend to result in a reduction in birth rates, which, coupled with reduced mortality rates due to improved healthcare, leads to a decline in overall population. The more developed economies are currently experiencing this phase (Bloom et al. 2009).

A steady increase in industrialisation and the requirement for human capital is seen by many scholars as a key element to kickstarting a demographic transition, particularly in the second stage of an industrial revolution. The improvement in technologies over time starts to require increased human capital capabilities, which convinces the population to rather invest to

improve the quality of life of their children, rather than the quantity of the children (Galor et al. 2000). Becker et al. (2012) noted that there is a negative relationship between fertility and education, with fertility rates also being impacted by the increase in earnings among women due to technological advancements (Galor et al. 1996).

2.4.2 Unified Growth Theory

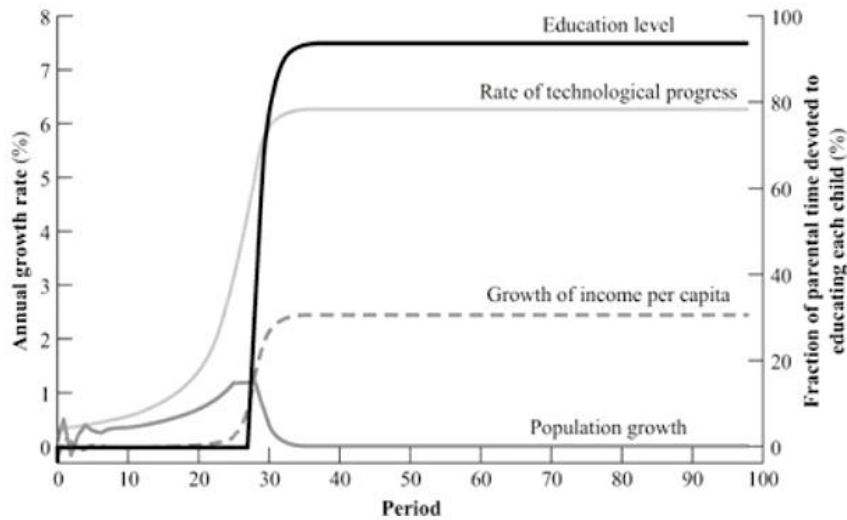
Galor et al. (2000) advanced the Unified Growth Theory with the objective of creating one framework that encapsulates the evolution from the Malthusian era to the modern era, with the related occurrences of demographic transition and the great divergence. The world's economy before the industrial revolution was stagnant, which was well documented in the Malthusian theory. The theory suggests that population growth contrasts with increased resources, which results in per capita income being at subsistence level. This means that if there are no advancements in technology (resources), the population and their income per capita stays the same. Technological advancements will thus result in positive growth in a population, resulting in the reduction of income per capita. During the last two centuries, the globe has experienced an increase in economic growth, per capita income and population rates, which the Malthusian theory is unable to explain.

Porter (1990); Porter et al. (2002), noted that there are three phases of competitiveness that impact economic advancements, i.e., the factor-driven phase, the efficiency-driven phase and the innovation-driven phase. The factor-driven stage is characterised by basic cost efficiencies in the manufacturing of commodities and/or low value-added products. This phase has a large proportion of non-agricultural self-employment. The small companies that are involved in manufacturing and providing services are mainly sole proprietorships. Almost every country experiences this phase, where they create no inventions and do not export. Porter et al. (2002) explained that during the basic level of advancement, the primary factors of production, such as primary commodities, unskilled labour and land, contribute towards economic growth. As the country grows to become middle income, advancements in the economy are achieved from using imported technologies. The country's domestic markets integrate with the global system through joint ventures, foreign direct investment and subcontracting activities. This then enhances technologies, which results in the inward flow of foreign capital and more technologies, which leads to sustainable economic growth and development. The countries that transform to high income tend to develop their own technologies.

The Unified Growth Theory incorporates the dominant elements of the Malthusian economy but where the technology and population are integrated. The crux of the Unified Growth Theory is to encapsulate the impact of the accumulation of capital and advancements in technology and how they both offset the negative impact of the increase in population on per capita income, as underscored in the Malthusian theory. The population increase as a result of demographic transition, coupled with improvements in human capital, results in increased productivity outputs, offsetting the impact of the increasing population. The Unified Growth Theory concludes that the higher need for human capital results in a reduction in the fertility of females and creates a catalyst for demographic transition. The population then gets an increased benefit from its own consumption and from the reduced quantity of children to enhance the standard of living for their children. The families are able to decide on their desired quality of life and the number of children to have within the constraints of the time needed for the upbringing of children and labour market activities. While there is an increase in income due to the demand for human capital, this does not set off a reduction in fertility, due to the clash between income and the substitution effects. This effect therefore increases the need for human capital and possible future earnings of a child creates a clear substitution effect. It motivates families to exchange quantity for quality of children, resulting in a decline in fertility. With further population transitions and reduced population growth rates comes a modern state of sustained economic growth.

Figure 6 details the time path of a worker's level of education, average annual growth rates of a population, technology and potential income of each worker. One can observe an increase in income growth from 0 percent to above 2 percent, which is the evolution from the Malthusian era to an era of sustainable economic growth. The transitioning away from the Malthusian era is correlated at the beginning with an increase in population, after which the development of human capital, coupled with a reduction in population growth, transitions the economy into a state of sustained economic growth.

Figure 6: A quantitative analysis of the Unified Growth Theory



Source: Galor (2011)

2.5 EMPIRICAL LITERATURE

A demographic dividend captures how a country and/or region that has the majority of its population being of working age with fewer dependents can enhance development and cause an improvement in economic growth, merely due to the high proportion of individuals being productive (Bloom et al. 2003). There are two types of demographic dividends, the first dividends arises from an increase in productive employment of the labour force, which results from an increase in the working age population, who have the ability to increase economic output during the window of opportunity. The second demographic dividend yields from savings. This arises from the increase in life expectancy through improved healthcare and reduced family size, resulting in the ability to save (Bloom et al. 2003; Mason et al. 2008). Savings and accumulated wealth contribute to an increase in economic growth when they are focused towards productive investment. It is critical that there is quality investment in healthcare and education to improve human capital in order to take advantage of the window of opportunity (Bloom et al. 1998; Bloom et al. 2003). The window to potentially yield demographic dividends is considered to be when the dependency ratio is less than 60 percent and female fertility declines to less than three children (United Nation, 2004). The dependency ratio is determined by the total dependent population compared to the total working age population. The dependent population is the total of the population younger than 15 and older

than 65. This ratio highlights how much of the non-working age population depends on the resources generated by the working class. In general, the working age population will generate resources that are more than that required for consumption, however the dependent population consume more than they produce. Typically, economies that have a higher proportion of their population being of working age will generate large levels of per capita income. Fertility rates of less than three children per woman allows for quality investments in children in the form of healthcare and education, which then influences the increases the human capital skills base for the future. Fertility has an impact on the population age composition as well as capital intensity (Bloom et al. 2003; Bloom et al. 1986; Bloom et al. 1998; Brander et al. 1994; Kelley & Schmidt 1994). A decline in fertility reduces the amount of time a woman requires for raising children, which frees some time and allows females to participate in the labour market. Once they partake in the labour market, they are able to contribute towards each of their children's healthcare and education (Bloom et al. 2009). Mierau et al. (2014) noted that population growth that comes from increased fertility reduces economic growth, but economic growth increases when the increase in population results from a reduction in mortality. This is due to an increase in savings which increases economic growth, i.e., savings increase when there is a decline in mortality, whereas higher fertility has a negative effect on savings. Yoo's (1994) study of the US economy observed that an increase in population that includes an increase in the number of children reduces economic growth, due to the use of earnings for healthcare and education instead of productive activities. However, when this cohort of children become of working age, they have a positive impact on economic growth as a result of partaking in productive labour and saving. This improvement in economic growth improves the quality of life of the population. Bloom et al. (2004) similarly highlighted the importance of age structures, noting that a baby boom cohort that enters the labour market has a positive impact on economic growth through productivity and savings.

As with the determinants of demographic dividends, there is an co-dependent relationship between the variables. Jayachandran et al. (2009) presented robust evidence that shows that individual educational attainment has a positive relationship with life expectancy. Another instance of the reciprocal effect of the variables was noted by Blanchard (1985), who observed that an increase in life expectancy has a positive relationship with savings. Hurd et al. (1998) also found that in the US, household wealth increased with increased life expectancy, while Lee et al. (2000) noted that since 1960, Taiwan has experienced that an improvement in life expectancy has a significant effect on savings.

Labour supply

Demographic transition results in an increase in labour supply due to the increase in the working age population. When the labour supply increases, the dependency ratio declines, i.e., as there is a rise in the percentage of the working age population, there is also an increase in the number of women entering the work force, mainly as a result of low fertility. The increase in these two cohorts results in an increase in productivity in the economy, thereby increasing economic growth through the increase in per capita income. La Porta et al. (2014) observed that an expansion in the formal sector results in an increase in economic growth.

An important study on the correlation between population and economic growth was conducted by Bloom et al. (1998), who argued there is a time period in which the population composition changes that results in rapid economic growth. They referred to this as the “demographic gift”. These findings created curiosity due to five aspects: (i) the results showed that a change in age structure contributed an estimated 34 percent of the East Asia economic miracle and was therefore quantitatively significant; (ii) the econometric model applied in the study was the basic conditional convergence framework applied in several other studies performed before the economic expansion; (iii) the demographic dividend evaluation offered a framework in which previous studies of the elements of expansion in the economy might be constantly incorporated; (iv) the method had a curious contrast between the economic outlooks of Southeast Asian and South Asian economics; and (v) numerous individuals had strong earlier theories but did not have compelling empirical explanation that economic expansion and demography are deeply related.

There has been other research performed on understanding the impact of population growth on an economy. Sethy et al. (2015) and Tumwebaze et al. (2015) observed that in India, East and Southern Africa, an increase in population had a positive effect on per capita economic growth. Kelley and Schmidt (2005) established the mode for demographic dividend by separating the demographic determining factor of the expansion referred to as the “productivity effect” calculated as the yield of the working age person and the expansion of yield per capita resulting from the variations in the portion of the working-age people in the total residents of the country (the “translations effect”). These authors researched the per capita economic growth in 86 countries over four 10-year periods between 1960 and 1995 and found that the demographic shifts globally amounted for roughly 20 percent of economic expansion, with the largest results being seen in Europe and Asia. Yao et al. (2013) noted the opposite effect, observing a negative

impact on GDP per capita in China and Australia. Huang and Xie (2013) also observed a negative effect on economic growth. Due to these opposing views, scholars have noted that the impact is not uniform, but instead varies depending on a country's social and economic conditions. Becker et al. (1999) observed that a population increase in less developed countries classified as low-income countries reduces per capita income growth as a result of the diminishing returns of the increasing working population. In contrast, an increase in the working population in high income countries has an effect of increasing per capita income due to higher human capital and specialisation of the labour force. Bucci (2015) observed that there is a positive correlation between increased population growth and economic growth as a result of the increased specialisation and complex production process in the economy. Headey et al. (2009) observed that in low-income countries, an increase in population reduces economic growth, while high income countries see a decrease in population reducing economic growth.

In general, there seems to be agreement that the age structure of a population is the determining factor of whether there will be increase in economic growth or not, coupled with the levels of human capital that population possesses. The dynamics of this age structure vary from country to country, for example, in Japan a large proportion of the population is 65 years and older, which slows down the economy. This can only be offset by a significant rise in productivity and per capita output. In Sub-Saharan Africa, however, the age structure is the opposite, i.e., there is a much younger population that is fully depending on the resources of the working age population. This young population requires resources to be invested in them in order to increase their human capital. The potential positive impact will be seen when the young population enters the labour market and increases productivity. It is on this basis that one can conclude that the impact on economic growth arising from population growth is dependent on the age structure of the population, which is highly country specific.

Women make up approximately 50 percent of the population, meaning that half of the labour force will come from females. Therefore, when there is an increase in the number of women entering the labour force, it reduces the gender inequality gap and increases economic growth, which also alleviates poverty by improving women's economic positions (Knowles et al. 2002). The labour participation of females still trails behind their male counterparts, however, as female participation is only 53 percent globally and 63 percent in SSA. Male participation is much higher at 80 percent globally and 74 percent in SSA (World Bank, 2019). This presents

an opportunity for improved economic growth as the female participation is not at maximum levels yet in SSA and globally.

Bloom et al. (2009) observed that the female labour supply is negatively impacted by the number of children born per woman; each birth reduces a female's ability to work by close to two years. Mishra and Smyth (2010) observed that female labour supply decreases by 0.4 percent when fertility increases by 1 percent, while Gonzales et al. (2015) highlighted the positive impact on economic development when gender inequalities are addressed. Cuberes and Teignier (2014) noted in their study that in the short run women being excluded from entrepreneurship causes a decline of 10 percent on income per capita by 10 percent, and in the long run the impact is 11 percent once the capital stock adjusts to the new lower levels of productivity. The study further noted that if women are excluded from the labour force, in the short term this will result in a decline of output per capita of 47 percent, while the long-term impact will be 50 percent. At a country level, they observed that the highest loss of GDP due to economic gender gaps are in North Africa and Middle East, with the five highest countries being Qatar, Oman, Iran, UAE and Algeria with rates ranging from 30 to 38 percent. Similar results were observed by Cavalcanti and Tavares (2016) utilising US data, where a decline of 25 percent of the original output is due to a 50 percent increase in the gender salary gap. Baerlocher et al. (2021) studied 100 countries between the period of 1980 and 2005 with points at five-year intervals, and similarly observed a positive correlation between economic growth and female labour force population.

Human capital

Various researchers have identified that the key pillars of human capital are quality education and good health (Hanushek et al. 2012). For a country to reap the rewards of good education, it is important that learning is experienced for a longer period. Bloom et al. (1998) researched the impact of education on per capita income during the period from 1965 to 1990 in 78 countries and determined that demographic dividends and education are closely related. The level of human capital was one of the independent variables, which was measured by the dataset from Barro and Lee (1993), depicted as the log of the average years of post-primary schooling of the population 25 years and older. The regressions depicted that the variable (education) was positive and statistically significant.

Glewwe (1999) concluded that in developed countries, female education has a long-term effect on generations to come as a mother's schooling has a positive correlation with her children's health and nutrition. This is in addition to an increase in human capital accumulation from educating a female, which assists in breaking the cycle poverty, particularly in developing countries.

Historically, the quality and level of education has been measured by the number of years in which the population receives their primary education, therefore mean years of schooling and school life expectancy have been common measures of education in various studies. In more recent research, scholars have identified that quality of education is just as important as the years spent in school. Pritchett (2013) highlighted that schooling, and the associated years (quantity) is not a complete proxy for education, as the quality of education has a significant impact on education as a whole. Therefore, both quality and quantity are important in obtaining a good education. The research showed that six out of ten adolescents globally do not meet the basic proficiency levels in reading and mathematics. Filmer et al. (2020), through the Learning Adjusted Years of School (LAYS) one can understand the number of schooling years (quantity) and measured learning (quality) of education. Angrist et al. (2021) also described the importance of quality and quantity in an education system. Their study showed that many of the developing countries are close to achieving substantial levels of schooling, i.e., 10-12 years of school, however the developing countries are yet to achieve this.

It is widely documented that innovation in the form of inventions, new technologies and development is strongly associated with economic growth. This type of innovation requires expertise in the fields of science, technology, engineering, and mathematics (STEM). It is therefore critical for economies to be able to develop such expertise through its schooling systems (Rothwell, 2013). Fagerberg (1994) suggested that variation in a country's income is due to differences in productivity, with technology being key, while Matos et al. (2013) observed that innovation is important for creating sustainable development.

Good health that results in an increase in life expectancy has been determined to be an important element of a growth model (McCoskey, 1998; Narayan, 2006). Bloom et al. (2003) observed that human capital in the form of health impacts growth directly by its influence on the burden of illness on the economy and productivity of the labour force. The study found that each year of improvement in life expectancy adds an additional 4 percent to output. Further, Bloom et al. (2014a) estimated that in China and India combined, five groups of non-

communicable diseases reduced capital accumulation and labour supply to the value of US\$34 trillion in lost output over 18 years. Weil (2007) estimated that minimising the health gap between countries will reduce the variance in log gross domestic product per employer by 10 percent, showing that health has a positive and significant impact on income. He also found that an increase of 20 years in life expectancy to 60 results in a long-term increase in GDP per capita of 15 percent, and even more importantly, should life expectancy not continue to improve at all after the first 40 year period the output per capita will be lower and start to reduce. Lorentzen et al. (2008) analysed the impact of adult mortality and concluded that a high mortality rate has a negative impact on economic performance and therefore reduces economic growth, while Madsen (2006) observed 21 countries and noted that health has a substantial impact on economic growth.

Currie et al. (2010) found that children who are often ill and unable to attend school have limited learning capacity, which results in cognitive impairment. This was further supported by Howitt (2005), who found that chronic poor health can have a negative impact on innovation as it reduces the capacity to be creativity and reduces entrepreneurship. Fincher et al. (2008) study similarly showed that populations with increased pathogen stress have much lower levels of innovation and out-the-box thinking.

The research of Cervellati et al. (2011) noted that the demographic transition is a critical turning point in the causal relationship of life expectancy, increasing per capita growth in select countries. The results show that post transition countries had a significant robust and positive relationship between increased life expectancy and per capita income. The researcher commented that an increased life expectancy without transition will merely increase the population, therefore countries must go through demographic transition when there is low fertility and mortality, and then only will an increase in life expectancy result in economic growth.

Savings

Savings largely contribute to the second demographic dividend, with savings coming about as a result of an increase in per capita income from a change in demographics; the population living longer which creates the need to save for when they retire; and the population having fewer children which provides an opportunity to save resources. Increased savings thus create better prospects for more rapid economic growth. Lee et al. (2000) observed Taiwan pre and

post demographic transition, noting that pre transition the population growth was 1 percent, life expectancy at birth was 28.3 years, the number of children per female was six, and savings as a percentage of income per year was 4 percent. In comparison, post transition the population growth was 0 percent, life expectancy at birth was 78.8 years, the number of children per female was two, and savings as a percentage of income per year was 8.3 percent. The demographic transition thus had a significant impact on savings, seeing a more than 100 percent improvement. Lee et al. (2000) thus concluded that an increase in life expectancy increases capital, which then increases per capita income. Various other studies also support the view that factors of demographic have a statistically significant impact on savings (Williamson & Higgins, 2001; Bloom et al. 2003; Solow, 1956).

Neoclassical Growth Theory stipulates that savings precede economic growth as they are a source for investment through capital formation, which then leads to economic growth. The investments raise the production capacity in an economy, which then increases economic growth (Mason et al. 1998). The capital markets deepen and there is increased growth in output per productive labour, due to savings being invested into the domestic markets. The increase in domestic savings improves the depth and liquidity of a country's financial system as it improves resource allocation using the domestic currency; allows for diversification and risk management as it reduces the need to lend externally, most likely in a foreign currency; and therefore promotes financial stability. The improvement in financial stability comes as a result of a country's financial development being resilient to shock relating to volatile capital flows. This stability has the effect of increasing economic growth (Sahay et al. 2015). The current account and a nation's income improve when savings are invested internationally. Therefore, whether the savings are invested locally or internationally, they have a positive impact on per capita income.

The overriding requirement for demographic dividends to materialise and yield favourable economic results is the existence of economic policies that complement the increase in population, and more specifically the working age population.

2.6 SUMMARY

This chapter described the current and projected population of SSA, as well as its current and projected social and economic performance. The chapter then provided an empirical review on demographic dividends and their determinants. The literature is largely in agreement on the

determinants that are required in order to yield dividends. The study of demographic dividends mainly having taken place in Europe, the US and Asia, there is limited research on SSA in relation to the possibility of achieving demographic dividends in the coming decades with the increasing population. In addition, no SSA sub-region-specific studies were found to provide an in-depth review of the possibility of yielding demographic dividends. This study will thus address this gap in the literature.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

This section will detail the research approach and design applied to answer the research questions and hypotheses documented in Chapter 1. This chapter describes the data sources, sample period and sample size and then the rationale why the selected empirical model and quantitative techniques were used to estimate the relationship between the dependent and independent variables.

3.2 RESEARCH APPROACH

In literature there are three approaches used to perform research: qualitative, quantitative, and mixed method (Creswell, 2003). The aim of the qualitative approach is to get an understanding of human experiences in order to explore the meaning behind a particular phenomenon. This approach is based on nonnumeric data. The quantitative approach uses statistical analysis in order to test a hypothesis based on sample data, with the intention of making general inferences to the population within a region (Babbie, 2010). The research approach utilised in this study is the quantitative method, as the research was based on numeric data that was used to test the hypotheses previously discussed in Chapter 1.

3.3 RESEARCH DESIGN

The research examined multiple numerical hypotheses, which were tested using secondary data from the United Nations, World Bank and UNESCO.

3.3.1 Data and sample

The benefits of using data from sources such as the World Bank and the UN, is that they are reliable, easy to access and cost effective. As the data were extracted from reputable databases, it can be concluded that the panel data information were trustworthy.

The data for the variables were annual panel data for 19 years, the period from 2000 to 2018. The data were obtained for 40 of the 48 countries in the SSA region. Due to data limitations for the period under review, eight countries were excluded (see Annexure 1). The secondary

data collected for SSA included: (i) population and demographic data for the working age population and female working age population; (ii) life expectancy data; (iii) number of school life expectancy years; (iv) per capita gross domestic products; and (v) savings as a percentage of GDP. The control variable data were: (i) natural resources rents as a percentage of GDP; (ii) rule of law indicator; (iii) technology achievement index; and (iv) trade as a percentage of GDP. The data collected that is in monetary terms is in US dollars unless stated otherwise.

3.3.2 Empirical model

This section details the empirical model applied in this research. The study applied two estimators to test the hypotheses – the Autoregressive Distributed lag (ARDL) and the Generalised Method of Moments (GMM). Pesaran et al. (1999) suggested the use of the ARDL technique as it allows for the interpretation of the long-run equilibrium relationship, while Blundell and Bond (1998) and Ullah et al. (2018) recommended that such a study apply the GMM, as it is the most appropriate for dynamic panel data. These models were used to ascertain the type and level of correlation between the dependent variable, i.e., GDP per capita, and the independent variables, i.e., labour supply, human capital and savings. The model was controlled by the control variables that also have an impact on GDP per capita, i.e., natural resources, technology, rule of law and trade openness.

The ARDL estimator applied the below model:

$$GDPpc_{i,t} = \beta_1 LbS_{i,t} + \beta_2 HC_{i,t} + \beta_3 S_{i,t} + \beta_4 NR_{it} + \beta_5 RoL_{i,t} + \beta_6 T_{i,t} + \beta_7 TO_{i,t} + \varepsilon_{i,t}$$

The GMM estimator applied the below model:

$$GDPpc_{i,t} = \alpha GDPpc_{i,t-1} + \alpha GDPpc_{i,t-2} + \beta_1 LbS_{i,t} + \beta_2 HC_{i,t} + \beta_3 S_{i,t} + \beta_4 NR_{it} + \beta_5 RoL_{i,t} + \beta_6 T_{i,t} + \beta_7 TO_{i,t} + \varepsilon_{i,t}$$

$GDPpc_{i,t}$ denotes the per capita Gross Domestic Product; $LbS_{i,t}$ denotes the Labour supply variable; $HC_{i,t}$ denotes the Human Capital variable; $S_{i,t}$ denotes the Savings variable; NR_{it} denotes the Natural resources variable; $RoL_{i,t}$ denotes the Rule of Law variable; $T_{i,t}$ denotes the Technology variable; $TO_{i,t}$ denotes the Trade Openness variable; t denotes the year of data observation; i denotes the panel data observation; ε_t refers to the random error term; β_0 is the intercept; and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ and β_7 are the coefficients.

3.3.3 Definition and measurement of variables

This section contains descriptions of the variables used in this study. As detailed in the empirical literature review, the catalyst for potential demographic dividends is the age structure of the population that results from demographic transition. The transition results in a significant proportion of the population being of working age, therefore reducing the dependency ratio of a country. This increase then creates a platform for increased productivity. In order for the increased labour supply to have a positive correlation with economic growth, there needs to be quality human capital in the form of quality education and healthcare. A population that has quality human capital would therefore be able to improve a country's economic productivity and output, resulting in an increase of GDP per capita. The increased income with increased life expectancy and fewer dependents are a catalyst for savings and wealth accumulation. Three main variables (labour supply, human capital, savings) have an impact on yielding demographic dividends measured as an improvement in GDP per capita.

3.3.3.1 Dependent variable: GDP per capita

GDP is the accepted measure of economic performance of a country and/or region. Given that the working age population in SSA is on the rise, it is expected that there would be an increase in output per capita of the country or region (Bloom et al. 1998). The fixed output per worker, coupled with the increase in the working-age population, will result in an improvement in output per capita (Mason, 2005). GDP per capita is measured by dividing the total GDP by the population of the country or region. When there is an increase in GDP per capita in an economy whilst experiencing an increase in its working age population this implies that the economy is yielding demographic dividends. The annual GDP per capita statistics for the 40 SSA countries were obtained from the World Bank.

3.3.3.2 Independent variables

Similar to the empirical literature discussed in Chapter 2, the following independent variables are determinants of demographic dividends.

(i) *Labour supply*

Population is the main driver of potential demographic dividends, as the age structure arising from demographic transition, it will give rise to a much more significant proportion of the

working age population in a country or region. This demographic transition results in a decrease in the dependency ratio of a country or region, due to the increase in the percentage of those of working age and a reduced proportion of dependents who are younger than 15 and older than 65 (Galor, 2005). The population data, i.e, number of working age population and female working age population, for 40 countries within the four sub-regions in SSA was obtained from the World Bank.

(ii) *Human capital*

Human capital levels are determined by quality of education and health. The World Bank established the Human Capital Index in 2010 to measure education and health, however the HCI data does not cover the study period of 2000 to 2018. The HCI could therefore not be used in the study, resulting in individual data being obtained for education and health. The quality of education is measured by the average length of education years in a country or region; it is expected that the more years spent receiving education, the better the quality of education, which contributes positively to economic growth (Bloom et al. 1998). Pritchett (2013) concluded that learning in school has a significant influence on improving human capital. The quality of learning can be measured by harmonised test scores, however due to the metric and associated research being fairly recent, the test score data were not available for the period under observation. The importance of these two individual measures has been supported by researchers, which prompted the World Bank to establish a metric, the Learning Adjusted Years of Schooling (LAYS), to determine the quality and quantity of education as it accounts for access and quality in absolute terms. However, similar to the HCI and harmonised test scores, the LAYS is also a recent metric and therefore did not have sufficient data to cover the study period. Due to the lack of availability of these data sets, education was assessed based on the quantity metric, which was measured according to schooling life expectancy. This data was obtained from UNESCO.

It is generally accepted in literature that life expectancy is a proxy to quality of health. Life expectancy increases when there is a reduction in mortality, and mortality decreases due to improved health conditions in a country where there is enhanced access to health infrastructure and modern medicine (Bloom, 2003). Life expectancy statistics were obtained from the World Bank.

(iii) Savings

As a population transitions and there are fewer dependents, consumption habits are reduced, creating a catalyst for the working age population to be able to save an increased portion of their income. Further, with a decline in mortality and increase in life expectancy, people living beyond 65 need to make provision for retirement. These factors combined create increased savings levels in a country or region. An increase in a country's savings results in economic advancements for that country (Crespo Cuaresma et al. 2017). Savings increases largely impact the second dividend. Savings as a percentage of GDP data were extracted from the World Bank.

3.3.3.3 Control variables

Control variables were included in this research and were held as constant in the model. The purpose of adding these variables was to limit the possible over estimation of the effect on the dependent variable by the independent variables. The below variables have an impact on GDP per capita, however they were not the main interest of this study.

(i) Natural resources

Natural resources has an impact on the performance of an economy, yet over the years two schools of thought have developed, with one arguing that natural resources have a positive correlation with GDP, and the other, the opposite. A negative impact on GDP has been viewed as a resource curse due to issues such as poor governance and economic complexity. Nations outside of Africa have been able to yield economic benefits from their natural resources, and for those countries, having natural resources was a prerequisite to improving their economic growth (Rostow, 1960; Robinson et al. 2006; Cavalcanti et al. 2011). Various studies have observed the opposite effect, however, concluding that a country having natural resources does not necessarily result in economic progress (Sachs et al. 2001; Badeeb et al. 2017; Tabash et al. 2022). SSA countries such as Nigeria, Angola, Tanzania, Botswana and the DRC are blessed with natural resources like diamonds, gas, oil and agricultural land, however their populations live in poverty. On the other hand, countries like China, Singapore and Japan that do not have an abundance of natural resources but have stronger economies (Gylfason et al. 2006).

It has been observed that natural resources have a positive effect on economic growth when there are good quality institutions (Mehlum et al. 2006), while other research has suggested

that the natural resource curse for African countries is due to low levels of economic complexity. The economic complexity of a country is determined by how complex the production capabilities are. Economies with higher complexity have been seen to have more diverse economic activities, which results in diversity in their exports and improvements in their economies. This is seen in the economic complexity index of Nigeria, the DRC and Angola being 1.99, 1.80 and 1.71 respectively, whilst countries like Japan have scored 2.48 (Tabash et al. 2022). Considering the above, it is clear that natural resources have an impact on GDP, whether negative or positive. Consistent with Bloom et al. (1998) natural resource abundance measured by primary product export as a percentage of GDP was included in their study. The metric associated with natural resources in this study is natural resources rents as a percentage of GDP, which has been obtained from the World Bank.

(ii) *Rule of law*

The rule of law is key for economic development as it mandates the accessibility and accountability of the government agencies that are charged with protecting institutions and individuals. When there is efficient governance in a country it creates a platform for a fair environment and protects the rights of individuals and institutions. The rule of law also allows for the strong safeguarding of property rights, which motivates trade and investment. Countries that have established good governance and enforce rights experience long-term economic growth (Kaufmann et al. 1999; Haggard et al. 2011). Chauvet et al. (2004) observed that particularly in developing countries, good governance is critical to economic growth. They estimated that countries with low levels of governance experience 2.3 percent less growth in GDP per annum. Haggard et al. (2011) also concluded that when governments are weak and unable to provide effective law and order, it is the biggest barrier to economic growth.

Fawaz et al. (2021), meanwhile, researched the effect of governance in high- and low-income countries, and inferred that the rule of law was positive at 0.2135. Governance in a form of rule of law is positively correlated with economic growth. The use of rule of law as a control variable is consistent with Bloom et al. (1998), who used the quality of government institutions in their analysis. The rule of law metric is measured by the World Bank through the Worldwide Governance Indicators (WGI), which were established by Kaufmann et al. (1999).

(iii) *Technology*

Through various theories such as the Unified Growth Theory and other research, it has become accepted that technological advancements are one of the critical pillars of economic growth, combined with capital accumulation and work force population. Technology is able to increase output with the same level of inputs in a production process, which makes countries more competitive (Çalışkan, 2015). The neo-classical theory states that technological transformation has the ability to increase income per capita, which then allows for savings and investments, resulting in an increase in GDP. Fagerberg (1994) suggested that inequality in countries' income is due to variance in productivity, with technology being key, while Matos et al. (2013) observed that innovation is important in creating sustainable development for a country. Desai et al. (2002) developed the Technology Achievement Index for the UN to determine a country's rating according to its technological advancement in terms of creating capabilities and using technology. This metric is a proxy for technology in the study.

(iv) *Trade openness*

In recent decades, trade openness has been highlighted as a key pillar of economic growth by multiple economic bodies i.e., World Trade Organisation, World Bank, UN and African Union. This view is further supported by empirical literature, for example, Brueckner's (2015) observation of the impact of trade openness on the economy of SSA showed that GDP would increase by 0.5 percent in the short run for every percentage increase in the ratio of exports and imports over GDP. This would have a cumulative long run effect of an improvement of 2 percent on GDP. Further, Sach et al. (1995) found that open developing markets experience growth of 4.49 percent per annum. Tahir et al. (2015) measured trade openness by industrial output as a percentage of GDP and noted a positive correlation with economic growth in the region of 10 percent in developing countries. Finally, Karras (2003), using the percentage of trade to GDP for 56 countries, observed that trade openness has a positive impact on economic growth where GDP would grow by 0.5 percent for every 10 percent increase in trade openness.

There have been fewer instances where researchers have noted a negative correlation between economic growth and trade openness, Abbas (2014) noted that \$289.86 million would be lost in developing countries for each one unit of increase in trade liberalisation. Ackah (2008) also noted that trade openness does not benefit the economies of low-income countries. Trade as a percentage of GDP has been sourced from the World Bank.

Table 4: Summary of variables

| Determinant | Data | Source |
|------------------------------|--|----------------|
| Dependent Variable | | |
| Economic Performance | GDP per capita | World Bank |
| Independent Variables | | |
| Labour Supply | Number of working-age population (16-64 years); Female-working-age population (16-64 years) | World Bank |
| Human Capital | Education proxied as schooling life expectancy (in years) | UNESCO |
| | Health proxied as life expectancy (in years) | World Bank |
| Savings | Savings as a percentage of GDP | World Bank |
| Control Variables | | |
| Natural Resources | Natural resources rents as a percentage of GDP | World Bank |
| Rule of Law | WGI – Rule of law indicator | World Bank |
| Technology | Technology Achievement Index | United Nations |
| Trade Openness | Trade as a percentage of GDP | World Bank |

Source: Candidates design from literature sources

3.3.4 Estimation approach

Panel data was used in this research to observe the long-run relationship between the changes in economic growth denoted by GDP per capita and the change in the working age population in SSA throughout the 40 countries in the four sub-regions. The use of panel data in a regression model allows the researcher to control and reduce collinearity issues between the independent variables and further addresses issues of excluded variables that may be correlated with independent variables in the model. This therefore allows for coping with the empirical state of unobserved heterogeneity correlated in the regression.

3.3.4.1 PMG estimator

The ARDL estimator consists of the Pool Mean Group (PMG), Mean Group (MG) and Dynamic Fixed Effort (DFE). The PMG estimator, which was developed by Pesaran et al. (1999), has the better trade-off when it comes to efficiency and consistency when compared to MG and DFE. The pooled mean group is regarded as appropriate for a long-run estimation when there is a condition of homogeneity amongst countries, whilst in the short run, the adjustment will be influenced by more country traits like monetary and fiscal adjustment mechanisms, sensitivity to external and domestic shocks, and imperfections in the market. Furthermore, the flexibility of the PMG estimator permits for homogeneity in the coefficient in the long run when there is a group of variables and/or countries. The PMG estimator allows for cointegration properties and dynamic effects, which allows for inferences to be made on

the long-run relationship amongst the variables. This is established through unit root testing, cointegration testing and VECM testing, which assess whether the panel data has a long-run equilibrium relationship amongst the variables. The PMG was utilised to estimate the long-run correlation amongst the variables after the performance of the Hausman test. When the PMG estimator is applied to panel data set it allows for dynamic and cointegration properties, and for long run coefficients it assumes homogeneity whilst in the short-run coefficients allows for the error variances to differ across countries. The PMG is more appropriate estimator than Mean Group (MG), as the MG is a completely heterogeneous-coefficient model that does not impose cross-country parameter restrictions and can be determined for each country that has adequately large time-series data (Loayza et al. 2006). The estimator is not as flexible, particularly for long-run homogeneity; when the time period is long, the degree of freedom is reduced for MG (Samargandi et al. 2015). Should the cross-country dimension be big, the long and short -run coefficients mean amongst the countries will be determined constantly by the unweighted average of each of the countries' coefficients. The dynamic fixed effects estimator is very similar to PMG; it limits all slope coefficients to be the same amongst all the countries, however it does permit for different country intercepts (Loayza et al. 2006). The DFE is subjected to endogeneity bias between the lagged dependent variable and error term in the simultaneous equation of the estimation (Baltagi et al. 2000). Based on the limitations associated with the Mean Group and Dynamic Fixed Effect, the Hausman tests performed concluded that PMG was the most appropriate ARDL estimator for this model.

3.3.4.2 GMM estimator

The variables included in the panel data utilised have a lagged effect in reality, i.e., it may not only be the current year labour supply and the associated human capital that will affect the GDP per capita of this year, but previous years' labour supply and human capital could also contribute towards the performance, therefore the lagged effect. The panel data is dynamic as it directly considers the time factor. When the model is dynamic it considers all the economic variables as a function of time. This is characterised by the speed of change in the output in response to the average time in modification function in the input variables. Further, in reality there are independent variables that may explain the dependent variable, however that is not part of the model, therefore this results in unobserved heterogeneity. These two factors highlight that the panel data is dynamic, as over time there is association of the cause-and-effect relationship of the phenomena.

Roodman (2009) suggested that a dynamic data estimation that utilises the lags of the dependent variables be included as an explanatory variable. The endogenous relationship is then controlled by the lagged variable. When the independent variables are correlated to the error term, or in a structured model the two error terms are correlated, endogeneity occurs. Ullah et al. (2018) noted that the error term in endogeneity bias is unobservable, thus there is no explicit method statistically to test whether the error term is correlated with the endogenous variable.

The dynamic data model is different from that of a static model, as the static model is timeless in nature and there is no temporary order of events (Safiullin et al. 2018). Dynamic data are better estimated by the Generalised Method of Moments, as it is able to analyse a number of variables with large data over a period of time. The GMM is well known for its ability to be efficient, robust, simple to use and flexible (Kiviet et al. 2017). In theory, the independent variables should not correlate with the error term; when this occurs, it may result in inconsistent estimates, coefficients having incorrect signs and invalid inferences being made by the researcher. This would lead to incorrect and inappropriate conclusions and theoretical analyses (Ketokivi et al. 2017). The error term in endogeneity bias is unobservable. Roberts et al. (2012) concluded that it is not possible to completely resolve the endogeneity challenge, therefore the GMM is appropriate for obtaining an efficient estimation that accounts for serial correlation.

Through a statistical process of internal transformation of the data, the GMM model is able to eliminate endogeneity. The GMM model will control various times of endogeneity by adding the previous performance of the variables through the lagged value of the GDP per capita dependent variable as an independent variable in the model. This will assist in controlling for (i) unobserved heterogeneity, (ii) simultaneity, and (iii) dynamic endogeneity, which are all sources of endogeneity. The statistical process occurs through the previous values of variables being subtracted from their present values, which results in a reduction in the amount of observations and improves the efficiency of the GMM model (Roodman, 2009). Blundell and Bond (1998) established that the GMM with more moment conditions is able to yield accurate estimates compared to the two-stage least square model.

There are two types of GMM models: the difference and system GMM. The GMM model also has two types of transformation processes being (i) the first difference transformation, also referred to as the one-step GMM, and (ii) the second order transformation, also known as the two-step GMM. The first difference transformation GMM is when the variable's previous

value is subtracted from the current value, however this method has limitations as it may result in losing too many observations. As a result, the second order transformation model is recommended as it abstracts the average of all future available observations of a specific variable, resulting in fewer observations lost (Roodman, 2009). Arellano et al. (1995) also regarded the second order transformation as more efficient and a consistent estimator for the coefficients. Based on the above, this study employed the two-step difference GMM.

3.4 CONCLUSION

This study investigated whether the region is on track to yield demographic dividends. This was done by evaluating the impact on GDP per capita from the changes in labour supply, human capital and savings. The study used panel data for PMG and dynamics panel data for GMM, covering a 19-year period from 2000 to 2018 for 40 countries in the four sub-regions, namely Middle, Eastern, Southern and Western Africa. Panel data were collected for the independent variables of labour supply, human capital and savings; the dependent variable of GDP per capita; and the control variables of natural resources, rule of law, technology and trade openness. The panel data were modelled utilising the ARDL Pooled Mean Group and in order to validate the robustness of the PMG results the two-step difference Generalised Method of Moments estimator was employed on the same dataset.

The next chapter will detail the findings based on the panel data analysed.

CHAPTER 4: DISCUSSION OF FINDINGS

4.1 INTRODUCTION

This chapter details the empirical results obtained from the modelling of the relationship between: (i) the working age population and GDP per capita; (ii) the female working age population and GDP per capita; and (iii) the relationship between economic growth and savings and human capital. The modelling was performed on 40 countries in Sub-Saharan Africa – a detailed listing of the countries and the sub-regions can be found in Annexure 1. The study used the EViews 12 software to perform the various statistical analyses. A summary of the panel data observed was 760 for each of the variables covering the period of 2000 to 2018 for 40 countries within the SSA region.

4.2 DESCRIPTIVE STATISTICS

The descriptive statistics of the variables are presented in Table 5. The mean of the variables appears reasonable in relation to the extracted data from the World Bank and UNESCO, and consistent with the information discussed in Chapter 1 relating to the main variables. The GDP per capita in the region has huge extremes – the minimum GDP per capita was \$111.93 and the maximum was \$22,942.61, which is consistent with the context of the region. The mean of GDP per capita is on the lower end in relation to the minimum and maximum data points, due to there being 25 low income, 16 lower middle income and 6 upper middle countries, and only 1 high income country.

As can be observed, all the variables, with exception of SAV and LE, do not have normal distribution as skewness and kurtosis are not approximating 0 and 3 respectively. Most of the variables are leptokurtic as the kurtosis is greater than three. This requires log transformation of the data in order to approximately conform to normality. Normality will then allow the study to make reasonable inferences regarding the regression results.

Table 5: Descriptive statistics

| | Mean | Medium | Maximum | Minimum | Std. Dev | Skewness | Kurtosis |
|---------------|-----------|-----------|----------|-----------|----------|-----------|----------|
| PC_GDP | 2097.510 | 882.7077 | 22942.61 | 111.9272 | 3170.539 | 3.250432 | 15.55820 |
| SLE | 7.756618 | 8.371340 | 12.01705 | 0.000000 | 2.998632 | -1.421047 | 5.182386 |
| LE | 57.22850 | 57.21700 | 74.51463 | 39.44100 | 7.030080 | 0.240406 | 2.840896 |
| WAP | 10841466 | 6012330. | 1.05E+08 | 51707.00 | 15054531 | 3.128236 | 14.75207 |
| FWAP | 5472856. | 3069182. | 51790875 | 25725.00 | 7514426. | 3.073810 | 14.34026 |
| SAV | 14.31894 | 14.38206 | 57.85012 | -19.90297 | 12.78310 | 0.440904 | 3.311252 |
| NR | 11.32598 | 7.670878 | 59.58416 | 0.000000 | 11.31580 | 1.903891 | 6.817113 |
| ROL | -0.655889 | -0.694305 | 1.023956 | -1.870021 | 0.634524 | 0.426332 | 2.568829 |
| TAI | 0.143680 | 0.129280 | 0.395212 | 0.022863 | 0.066667 | 1.325542 | 4.701486 |
| TO | 68.19722 | 58.64232 | 225.0231 | 0.000000 | 39.00025 | 1.131109 | 4.895181 |

Note: PC_GDP= per capita Gross Domestic Product; SLE= School Life Expectancy; LE= Life Expectancy; WAP= Working Age Population; FWAP=Female Working Age Population; SAV=Savings as percentage of GDP; NR=Natural Resources Rent as a percentage of GDP; ROL=Rule of Law; TAI= Technology Achievement Index; TO= Trade Openness.

Source: Author's own compilation from research data

4.3 MULTI-CORRELATION TESTING

As per Kennedy (2008), the classical linear regression assumes that there should not be high linear relationship amongst the independent variables. When there is high correlation in two or more independent variables within a model, this is known as multi-correlation. When multi-correlation exists, it reduces the number of data used by the estimator to determine parameter estimates, resulting in much greater variances as the coefficient is highly sensitive to small changes in the model. These high variances make the parameter estimates unreliable and imprecise and therefore limits the hypothesis testing. Multi-correlation problems occur once the coefficient is greater than 0.7.

Table 6 details the correlation relationship between the variables. It can be noted that all the correlation relationships between the variables are less than the 0.7 threshold, with the exception of log working age population (LWAP) and log female working age population (LFWAP), which are highly correlated at 0.999892. This is expected as LFWAP is a subset of LWAP. In addition, taking into account that the male to female population is 50:50 in SSA based on World Bank data, the variable will constantly move in the same direction and at a similar pace. In order to address the high correlation, the regression analysis was estimated in two parts: model 1a with LWAP and excluding LFWAP, and model 1b with LFWAP excluding LWAP.

Table 6: Summary of multi-correlation test

| Correlation Probability | LPC GDP | LE | LFWAP | LWAP | SAV | LSLE | LNR | LROL | LTAI | LTO |
|-------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|-------------------|
| LPC_GDP | 1.000000 ----- | | | | | | | | | |
| LE | 0.219927 0.0182 | 1.000000 ----- | | | | | | | | |
| LFWAP | -0.176251 0.0595 | -0.467992 0.0000 | 1.000000 ----- | | | | | | | |
| LWAP | -0.175896 0.0601 | -0.460261 0.0000 | 0.999892 0.0000 | 1.000000 ----- | | | | | | |
| SAV | 0.327062 0.0004 | -0.164415 0.0791 | -0.269340 0.0036 | -0.268839 0.0037 | 1.000000 ----- | | | | | |
| LSLE | 0.616357 0.0000 | 0.030565 0.7457 | -0.323441 0.0004 | -0.326500 0.0004 | 0.280289 0.0024 | 1.000000 ----- | | | | |
| LNR | -0.467573 0.0000 | -0.388992 0.0000 | 0.207924 0.0258 | 0.205999 0.0272 | -0.028170 0.7651 | -0.028245 0.7645 | 1.000000 ----- | | | |
| LROL | 0.424187 0.0000 | 0.476675 0.0000 | -0.737414 0.0000 | -0.736441 0.0000 | 0.328353 0.0003 | 0.405809 0.0000 | -0.433092 0.0000 | 1.000000 ----- | | |
| LTAI | 0.673920 0.0000 | 0.578570 0.0000 | 0.062487 0.5071 | 0.070871 0.4517 | 0.119837 0.2021 | 0.297198 0.0013 | -0.423983 0.0000 | 0.226110 0.0151 | 1.000000 ----- | |
| LTO | 0.300482 0.0011 | 0.398870 0.0000 | -0.764026 0.0000 | -0.761806 0.0000 | 0.329573 0.0003 | 0.328444 0.0003 | -0.367424 0.0001 | 0.657315 0.0000 | 0.199710 0.0324 | 1.000000 ----- |

Note: LPC_GDP= log per capita Gross Domestic Product; LSLE= log School Life Expectancy; LE= Life Expectancy; LWAP= log Working Age Population; LFWAP=log Female Working Age Population. SAV=Savings as a percentage of GDP; LNR=log Natural Resources Rent as a percentage of GDP; LROL=log Rule of Law; LTAI=log Technology Achievement Index; LTO= log Trade Openness.

Source: Author’s own compilation from research data

4.4 UNIT ROOT TESTING, COINTEGRATION TEST AND VECM

4.4.1 Unit root testing

Prior to performing a regression analysis, a researcher should first test the data of the variables for unit root. A unit root test assesses whether the data of the variable is stationary, as stationarity is critical in regression analysis as non-stationary data can result in spurious regressions. When there is stochasticity in the data model, the spikes and shocks effect in the data will disappear over time. Pesaran et al. (1999) highlighted that knowing the order of integration of the variables is not a prerequisite when using the Autoregressive Distributed lag estimator, the only requirement is that integration should be either at level or first difference. This study has performed the unit root test to confirm that the data is stationary at either level or first difference. When performing a GMM regression analysis, one of the requirements is that the data should be stationary. Arellano (2003) concluded that challenges associated with stationarity are particularly emphasised when the time-series observation is less than the cross-sectional unit. This condition was present in the data set used as the time series observation was 19 years (2000-2018) and the cross-sectional units were 40 countries.

Table 7: Unit root testing

| | Levin, Lin and Chu | | Im, Pesaran and Shin | | Augmented Dickey Fuller-Fisher | | PP-Fisher | |
|----------------|---------------------------|-----------------------------|---------------------------|-----------------------------|--------------------------------|-----------------------------|--------------------------|-----------------------------|
| | @Level | @1 st Difference | @Level | @1 st Difference | @Level | @1 st Difference | @Level | @1 st Difference |
| LPC_GDP | -8.31027 <i>0.0000</i> | -18.0864 <i>0.0000</i> | -2.48334 <i>0.0065</i> | -13.0681 <i>0.0000</i> | 109.286 <i>0.0165</i> | 387.179 <i>0.0000</i> | 158.039 <i>0.0000</i> | 424.908 <i>0.0000</i> |
| LSLE | -11.3919 <i>0.0000</i> | -12.3251 <i>0.0000</i> | -5.55922 <i>0.0000</i> | -10.0857 <i>0.0000</i> | 188.569 <i>0.0000</i> | 266.237 <i>0.0000</i> | 208.715 <i>0.0000</i> | 361.162 <i>0.0000</i> |
| LE | 12.8030 <i>0.0000</i> | -11.5895 <i>0.0000</i> | -8.21339 <i>0.0000</i> | -11.1294 <i>0.0000</i> | 504.538 <i>0.0000</i> | 357.258 <i>0.0000</i> | 138.533 <i>0.0001</i> | 131.313 <i>0.0003</i> |
| LWAP | 0.81322 <i>0.7920</i> | -3.47936 <i>0.0003</i> | 9.42311 <i>1.0000</i> | -1.09939 <i>0.1358</i> | 86.6294 <i>0.2868</i> | 160.950 <i>0.0000</i> | 383.390 <i>0.0000</i> | 190.867 <i>0.0000</i> |
| LFWAP | 1.35477 <i>0.9123</i> | -4.83119 <i>0.0000</i> | 9.75363 <i>1.0000</i> | -2.22797 <i>0.0129</i> | 70.6179 <i>0.7641</i> | 143.526 <i>0.0000</i> | 390.426 <i>0.0000</i> | 125.995 <i>0.0000</i> |
| SAV | -3.55656 <i>0.0002</i> | -20.1664 <i>0.0000</i> | -3.04298 <i>0.0012</i> | 19.3656 <i>0.0000</i> | 121.947 <i>0.0004</i> | 447.632 <i>0.0000</i> | 111.207 <i>0.0034</i> | 964.930 <i>0.0000</i> |
| LNR | -3.23409 <i>0.0008</i> | -15.5957 <i>0.0000</i> | -3.62337 <i>0.0001</i> | -14.1250 <i>0.0000</i> | 137.178 <i>0.0001</i> | 338.822 <i>0.0000</i> | 115.155 <i>0.0061</i> | 384.360 <i>0.0000</i> |
| LROL | -5.68063 <i>0.0000</i> | -18.9421 <i>0.0000</i> | -2.73235 <i>0.0031</i> | -16.1998 <i>0.0000</i> | 115.868 <i>0.0054</i> | 397.145 <i>0.0000</i> | 109.938 <i>0.0148</i> | 1063.90 <i>0.0000</i> |
| LTAI | -2.98693 <i>0.0014</i> | -24.6864 <i>0.0000</i> | 1.78389 <i>0.9628</i> | -21.4963 <i>0.0000</i> | 92.3930 <i>0.1622</i> | 535.148 <i>0.0000</i> | 104.141 <i>0.0362</i> | 840.413 <i>0.0000</i> |
| LTO | -3.34797 <i>0.0004</i> | -15.9142 <i>0.0000</i> | -1.90724 <i>0.0282</i> | -14.2506 <i>0.0000</i> | 113.941 <i>0.0076</i> | 354.995 <i>0.0000</i> | 88.1230 <i>0.2502</i> | 480.799 <i>0.0000</i> |

Note: LPC_GDP= log per capita Gross Domestic Product; LSLE= log School Life Expectancy; LE= Life Expectancy; LWAP= log Working Age Population; LFWAP=log Female Working Age Population; SAV=Savings as a percentage of GDP; LNR=log Natural Resources Rent as a percentage of GDP; LROL=log Rule of Law; LTAI=log Technology Achievement Index; LTO= log Trade Openness.

Source: Author's own compilation from research data

The Augmented Dickey Fuller (ADF) is the most commonly used stationarity test and was applied in this study. Further to this test, all four-unit root testing methods were applied for completeness to test the variables for stationarity, namely the Levin, Lin and Chu; Im, Pesaran, and Shin; Augmented Dickey Fuller-Fisher; and the PP-Fisher tests.

Table 7 summarises the unit root test performed. At a significance level of 5 percent, LPC_GDP, LSLE, LLE, SAV, LNR, LROL and LTO were stationary at level on all four of the unit root tests performed. The remainder of the variables, LTAI, LWAP and LFWAP, were stationary at first difference on Levin, Lin and Chu, Augmented Dickey Fuller-Fisher and PP-Fisher, results that the variables are stationary at first difference. Therefore when the variables are stationary at first difference it is required that a panel cointegration test be performed with the objective of assess the existence of a long-run relationship amongst the variables. This allow that should shocks and spikes affect the movement in the individual series, these would merge over time and therefore long-run inferences can be made on the regression.

4.4.2 Cointegration analysis

Based on the unit root testing, the panel data of this study integrates at different orders, i.e., at level and at first difference. The appropriate test to run to assessing cointegration on the panel data is therefore the Pedroni Residual Cointegration Test (Pedroni, 1999; 2004). The test checks for the existence of a long-run equilibrium relationship between the variables, by estimating the residuals subsequent to normalising the panel statistics with correction terms (Hussin et al. 2010). The Pedroni test consists of seven types of tests, split between the within dimension approach and the between dimension approach. The within dimension approach includes four of the seven tests and looks at the autoregressive coefficient across the members. The between dimension approach consists of three of the seven tests and estimates based on the average individually estimated coefficient of each member. Table 8 presents the summary of the tests performed.

As the majority of the t statistics were statistically significant, the null hypothesis that there is no cointegration could be rejected. As there is cointegration, there is thus a long-run relationship amongst the variables. The Kao residual cointegration test was also performed to further validate the Pedroni results. The estimates of the long-run model will be performed using the Vector Error Correction model (VECM), which can infer a causal long-run relationship.

Table 8: Cointegration Test results

| | Model 1a | | Model 1b | |
|---|-------------------------|---------------------------|-------------------------|---------------------------|
| <i>Pedroni Residual Cointegration Test</i> | <i>Statistic</i> | <i>Probability</i> | <i>Statistic</i> | <i>Probability</i> |
| Panel v-Statistic: within-dimension | -4.895644 | 1.0000 | -4.829892 | 1.0000 |
| Panel rho-Statistic: within-dimension | 7.654055 | 1.0000 | 7.388968 | 1.0000 |
| Panel PP-Statistic: within-dimension | -8.446300 | 0.0000 | -8.582228 | 0.0000 |
| Panel ADF-Statistic: within-dimension | -6.420359 | 0.0000 | -6.559511 | 0.0000 |
| Group rho-Statistic: between-dimension | 9.873621 | 1.0000 | 9.637087 | 1.0000 |
| Group PP-Statistic: between-dimension | -17.12164 | 0.0000 | -18.28896 | 0.0000 |
| Group ADF-Statistic: between-dimension | -8.817239 | 0.0000 | -8.701183 | 0.0000 |
| | | | | |
| <i>Kao Residual Cointegration Test</i> | <i>Statistic</i> | <i>Probability</i> | <i>Statistic</i> | <i>Probability</i> |
| ADF | -4.520742 | 0.0000 | -4.525682 | 0.0000 |

Source: Author's own compilation from research data

4.4.3 Vector Error Correction Model

When the coefficient is negative and significant, it further supports that there is a long-run equilibrium relationship amongst the variables. As the coefficient is -0.018679 and -0.018258 for model 1a and model 1b respectively at a probability of 0.0000 for both models, it therefore infers and validates that there is long-run relationship.

Table 9: Panel Vector Error Correction Model test results

| | Model 1a | Model 1b |
|----------------|-----------------|-----------------|
| Coefficient | -0.018679 | -0.018258 |
| Standard Error | 0.004286 | 0.004190 |
| t-Statistics | -4.357784 | -4.357114 |
| Probability | 0.0000 | 0.00000 |

Source: Author's own compilation from research data

4.5 REGRESSION RESULTS: POOLED MEAN GROUP ESTIMATOR

As the cointegration results and the VECM test suggest that a long-run equilibrium relationship exists amongst the variables, the PMG estimator was applied to assess the level of relationship between the variables. The PMG estimator was selected based on the Hausman Test, which is performed to determine which of the three ARDL estimators, being Pooled Mean Group, Mean Group and Dynamic Fixed Effect, would be more efficient for the model. The Hausman results

are detailed below, with the first rejecting the null hypothesis MG in favour of the PMG, as the p-value is greater than 0.05 and therefore PMG would be the most efficient estimator for the model. Similarly, the null hypothesis of DFE is also rejected in favour of the PMG as the p-value is greater than 0.05. For this reason, models 1a and 1b were both estimated using the PMG.

Table 10: Hausman Test results

| | χ^2 statistic | | P value > χ^2 | |
|------------|--------------------|----------|--------------------|----------|
| | Model 1a | Model 1b | Model 1a | Model 1b |
| PMG or MG | 1.27 | 1.06 | 0.7420 | 0.7650 |
| PMG or DFE | 1.16 | 0.92 | 0.9919 | 0.9961 |

The Hausman test for PMG, MG and DFE was performed using Stata as Eviews does not have the functionality to perform this test.

Source: Author’s own compilation from research data

4.5.1 Long-run effect analysis

The long-run and short-run results from the PMG estimation are presented in Table 11. The result of the three main independent variables of interest are discussed below, i.e., labour supply, human capital and savings.

(i) Labour supply (LWAP, LFWAP)

The results in Table 10 reflect that there is a statistically significant relationship between GDP per capita and labour supply through its proxy of working age population (LWAP) and female working age population (LFWAP). However, both models reflect that the relationship is negative, i.e., working age population and female working age population have a negative impact on GDP per capita. An incremental 1 percent increase in working age population and female working age population have an elasticity negative effect of -0.654 and -0.572 respectively *ceteris paribus*. These results are consistent with a study performed by Becker et al. (1999), who observed that a population increase in low-income countries slows per capita income growth due to the diminishing returns of the increasing working population. In contrast an increase in the working population in high income countries has the effect of increasing per capita income due to higher human capital and specialisation of the labour force.

Table 11: Sub-Saharan Africa PMG estimation results (2000-2018)

| Dependent Variable is LPC_GDP | | | | | | |
|-------------------------------|--------------|-------|--------|---------------|-------|--------|
| | Model 1a | | | Model 1b | | |
| | Coefficient | Z | prob>z | Coefficient | z | prob>z |
| Long-run Equation | | | | | | |
| LWAP | -0.65432 *** | -7.36 | 0.000 | | | |
| LFWAP | | | | -0.57170*** | -6.55 | 0.000 |
| LSLE | 0.13372 *** | 7.61 | 0.000 | 0.13655*** | 7.05 | 0.000 |
| LE | 0.08890 *** | 34.07 | 0.000 | 0.08646*** | 31.88 | 0.000 |
| SAV | 0.00321 *** | 6.07 | 0.000 | 0.00295*** | 5.80 | 0.000 |
| LNR | -1.82118 *** | -5.29 | 0.000 | -1.83714*** | -5.44 | 0.000 |
| LROL | -0.05078 * | -1.85 | 0.064 | -0.04216 | -1.56 | 0.119 |
| LTO | 0.11073 *** | 2.99 | 0.003 | 0.08576** | 2.43 | 0.015 |
| LTAI | 2.00323 *** | 5.90 | 0.000 | 2.00448*** | 6.03 | 0.000 |
| Short-run Equation | | | | | | |
| D(LWAP) | -7.52579 | -1.59 | 0.112 | | | |
| D(LFWAP) | | | | -6.46402 | -1.18 | 0.237 |
| D(LSLE) | 0.08325 | 0.28 | 0.783 | 0.14391 | 0.47 | 0.641 |
| D(LE) | 0.32267*** | 2.73 | 0.006 | 0.36524 *** | 2.77 | 0.006 |
| D(SAV) | 0.00248 | 1.56 | 0.118 | 0.00240 | 1.49 | 0.135 |
| D(LNR) | -0.09007*** | -3.15 | 0.002 | -0.09315 *** | -3.19 | 0.001 |
| D(ROL) | 0.14906** | 1.97 | 0.049 | 0.16048 ** | 2.07 | 0.038 |
| D(LTO) | -0.19547*** | -3.35 | 0.001 | -0.17693 *** | -3.07 | 0.002 |
| D(LTAI) | 0.00428 | -0.66 | 0.508 | -0.00527 | -0.76 | 0.445 |
| ECT | -0.36771*** | -6.57 | 0.0000 | -0.36632 **** | -6.54 | 0.000 |
| Countries | 40 | | | 40 | | |

Note: LPC_GDP=log per capita Gross Domestic Product; LSLE=log School Life Expectancy; LE=Life Expectancy; LWAP=log Working Age Population; LFWAP=log Female Working Age Population. SAV=Savings as a percentage of GDP; LNR=log Natural Resources Rent as a percentage of GDP; LROL=log Rule of Law; LTAI=log Technology Achievement Index; LTO=log Trade, Openness. ECT=Error correction Term. ***, ** and * denotes significance at 1 percent, 5 percent and 10 percent respectively. Source: Author's own compilation from research data

The results are also consistent with those of Kelley and Schmidt (1994), who concluded that in less developed countries there is a negative and significant relationship between GDP per capita and labour supply. In SSA, 25 countries within the region are classified as low or lower middle-income countries. These countries are associated with being less developed. This negative relationship, amongst other things, results from the steady increase in labour supply and erratic and low GDP per capita increases. In SSA's case, the labour supply increased at an average pace of 2.9 percent, with average GDP per capita growth of 1.6 percent during the period under observation. It can be clearly seen that the population is increasing much faster than GDP therefore resulting in diminishing returns. Bloom et al. (1998) observed East Asia (1965-1990)

and concluded that there is a significant and positive impact on GDP per capita when there is an increase in population. The working age population impact on GDP per capita is powerful and positive, this is evident the coefficient of 1.46. The coefficient is statistically significant and in large magnitude. The coefficient reflects that there is a 1.46 percent increase in GDP per capita for every for 1 percent increase in the working age population. East Asia had an increase in working age population increase of 2.39, with an average GDP per capita growth of 6.11. The effect of the working age population on GDP per capita based is significant, as the growth in GDP per capita was higher than the increase in population. Bloom further projected that based on the coefficient from the models in conjunction with the United Nations population forecast to 2025, Africa would experience an average of 2.40 percent growth in population and 2.78 percent growth in working age population, which would likely yield a 1.88 percent increase in GDP per capita. These projections are not materially off the observed period of this study, as growth in working age population increased by 2.9 percent and GDP per capita grew by 1.6 percent on average. Barro's (1991) study observed that the populations of SSA and Latin America (proxy was fertility) had a -1 percent impact on GDP, i.e., poor countries can only improve to the extent of richer countries if they have high level of human capital per individual relative to their GDP per capita. Bloom et al. (1998) stated that to yield demographic dividends through an increased labour supply, the labour supply needs to be in productive employment. The Solow neo-classical growth method dictates that in a steady state, an increase in population tends to decrease per capita income, but has no impact on per capita growth. In the transformation to a steady state, an increase in population reduced the per capita growth as this increase in population requires that the economy utilises the scarce savings to widen capital rather than deepen capital. This would be the case in SSA, where there is an increase in population and the working age population whilst a substantial portion of the working age population is unemployed and there hasn't been significant change in unemployment rates as total unemployment has ranged from 6-8% for the region and youth unemployment has remained in the range of 11-13% throughout the last two decades. These unemployment statistics are much higher than the rest of the globe as discussed in chapter 2. The inability to significantly increase participation in the labour market is resulting in the consumption of the limited resources the region has without generating positive output that increases GDP per capita.

(ii) Human capital

Education: School life expectancy (SLE)

As detailed in Table 10, LSLE has a positive and statistically significant impact on LPC_GDP; a 1 percent change in LSLE has a 0.13 and 0.14 elasticity effect on LPC_GDP respectively in model 1a and model 1b. This positive correlation can be attributable to the fact that school life expectancy has been increasing during the period of the study i.e., from 6.2 years in 2000 to 7.9 years by 2018. This increase comes as a result of increased access and resources being provided by government and none-governmental organisations. The net primary school enrolments rates which reflect access to primary education was noted to have increased from 60% in 2000 to 79% by 2018 (UNICEF, 2019; World Bank, 2020). These observed results are consistent with Bloom et al. (2003), who noted that education and training are amongst the key determinants of successfully yielding demographic dividends. The emerging global economy is placing significant importance on higher education. East Asia was able to yield demographic dividends due to part of the contribution from education on GDP per capita. Bloom et al. (1998) study used the proxy of log of years of secondary schooling, showing that a unit change in education has a 0.22 impact on GDP per capita.

Kelley and Schmidt (1994) highlighted that when families are poor or close to subsistence level, and capital markets are underdeveloped, the option of financing children's health and education is limited. This causes families to cater for short-run basic needs at the expense of long-run investment in human capital. In SSA, governments are the main providers of education due to the limited resources of the population. Idrees and Siddiqi (2013) noted that there is a positive correlation between economic growth and spending on education. Developed countries have progressed compared to developing countries due to their high investment in education, as education brings about innovation and improves technology. Education also limits the transmission of poverty from one generation to the next by providing increased opportunities to earn, while assisting the population to move other socioeconomic indicators forward. Benhabib et al. (1994) argued that the level of education has a significant impact on increasing per capita income. Their study found that an increase in public expenditure in education of US\$1 has an impact of increasing GDP by US\$27.29 in developing countries. It can thus be clearly seen that there is a significant benefit for the region to continue investing in education, particularly as it is the most lacking pillar in SSA's Human Capital Index and its importance is significant for economic growth.

The results of this study and studies mentioned above are important for the SSA region, as they show a significant relationship between education and GDP per capita. As previously noted, even though SSA has improved its schooling life expectancy, the region is still significantly behind when it comes to education, as an average child in SSA receive 8.3 years of schooling whilst a child elsewhere in the world will receive 10.8 to 13.3 years. SSA's learning adjusted years of schooling is five years compared to the average of 7.8 globally. Given these gaps, there is an opportunity to improve the benefit that can be yielded from better quality education.

Health: life expectancy (LE)

The coefficient of LE has a statistically positive and significant relationship with LPC_GDP in both models. When the independent variable LE changes by one unit it has a positive 0.09 percent effect on LPC_GDP in both models 1a and 1b. The SSA has invested significant resources in improving life expectancy and reducing mortality in the region over the past decades. With the increased access to medication and health care facilities has yielded results as life expectancy has increased over the past couple of decades since 1990. The result of the study is consistent with the findings of Bucci et al. (2019), who observed that life expectancy has a positive and significant relationship with GDP per capita with an associated elasticity of 0.61. Jayadevan (2021), meanwhile, indicated that economic growth would increase by 3.43 percent for every 1 percent improvement in health in a non-standardised model and 0.69 in a standardised model. Strauss et al. (1998), who concluded that as death rates fall, workers are shown to be much healthier, which increases productivity and has a positive impact on economic growth. These results are particularly important for SSA as life expectancy was 61 in 2018 and 62 in 2020. Both these rates are lower than the average global life expectancy and of even more importance, they are lower than retirement age of 65 years. This therefore has an impact on the economic activity of the region, translating to the economy losing at least three years of labour per working age person, who could have increased productivity and output for the region. Therefore, it is important that the region work continue towards improving life expectancy, as this will yield additional positive economic impact for SSA *ceteris paribus*.

(iii) Savings (SAV)

As detailed in Table 10, SAV has a positive and statistically significant relationship with LPC_GDP. For every unit of change in SAV, this has a positive impact of 0.003 on LPC_GDP for both models 1a and 1b . Even though the impact is positive it is low, which is due to the low

savings in the region as a result of limited resources and a high dependency ratio of 80 percent. The limited resources is influenced by the high unemployment rates in the region resulting in subsistence living which is reflected in the high dependency ratio of 80 percent. The results of this study is consistent with a study conducted by Thornton (2001), who noted that a high dependency ratio increases consumption and causes a decline in per capita savings. Household savings are limited as the investible resources are absorbed by the growing population. In the beginning phase of development when there is a significant amount of poor families within a population, families tend to utilise their incomes to accumulate assets such as land and property, than rather having financial savings that would reflect in the national accounts. Coala and Hoover's (1958) hypothesis was that an increase in savings rate is attributable to a reduction in dependency burden.

SSA has entered the first demographic dividends window, with Southern Africa's window opening in 2003, however the rest of the sub-regions are still to enter the window period. Mason (2005) noted that the second dividend, in the form of wealth accumulation, results from the demographic transition that yields the first dividend. The demographic transition caused by fewer dependents and longer life expectancy which enables the working age population to invest a portion of their income as their consumption requirements are much lower than when there are a lot of dependents and the need to save for retirement is more pressing due to increased life expectancy. Regions that have experienced the first dividend period will have a much higher second dividend, largely in the form of savings. East and South-East Asia has a 2.8 percent wealth ratio for their population older than 50, whilst Sub-Saharan Africa is only at 0.5 percent as they have just started their demographic dividend window. Lee et al. (2000) observed that demographic transition is a result of a decline in mortality and fertility and an increase in life expectancy, which had an significant impact on savings as a percentage of income (increasing from 4 percent to 8.3 percent) in Taiwan. Based on the above, SSA's ability to generate an improved savings pool will be largely dependent on whether the region is able to improve human capital as the dependency ratio declines. Without yielding the first demographic dividend, the region will be unlikely to yield substantial second dividends.

The following control variables reflected statistically significant relationships with GDP per capita:

(i) *Natural resources*

The natural resource variable (LNR) has a negative and statistically significant elasticity effect on GDP per capita of -1.82 and -1.84 *ceteris paribus* respectively for models 1a and 1b. This is consistent with various studies that showed that natural resources have a negative relationship with economic growth, resulting in the conclusion that Africa has a natural resource curse. The results are consistent with Tabash et al. (2022), who found a negative relationship (-3.090) between natural resources and economic growth in 24 African countries due to low economic complexity. Economic complexity was found to have a positive and statistically significant relationship with economic growth, as it has the ability to improve efficiencies and economic outputs. SSA has low economic complexity due to our limited production capabilities, these capabilities can be improved through innovation which requires education and technology advancements.

(ii) *Rule of law*

Rule of law has a negative and statistically significant elasticity effect on economic growth of 0.05 *ceteris paribus* for model 1a. These results are consistent with the study done by Gani (2011) which had found a negative relationship between rule of law and economic growth in developing countries. This type of negative correlation in the results are due underdeveloped legal system and weak enforcement of the law.

(iii) *Trade openness*

Trade openness has a positive and statistically significant elasticity effect on economic growth of 0.11 and 0.09 for models 1a and 1b respectively. These results are in line with a study performed by Amedu et al. (2022), who observed the impact of trade openness on the economies of select West Africa countries. Their study found that trade openness has a significant and positive relationship with GDP; using the fixed effect estimation they noted that trade openness has a coefficient of 19.53 on growth in GDP.

(iv) *Technology*

Technology also has a positive and statistically significant elasticity effect on GDP per capita of 2.00 for both models 1a and 1b. This is consistent with various economic theories, including that by Solow (1985). It is also consistent with a recent study performed by Bahrini et al. (2019),

who used information and communication technology as a proxy for technological advancements. They noted a positive and significant relationship between technology and economic growth, with technology contributing 7 percent to the economy.

4.5.2 Short-run effect analysis

The PMG estimator was performed for the model applied in this study (see Table 10). The error correction term (ECT) in a dynamic model suggests the speed at which equilibrium is restored. The ECT was negative at -0.368 and -0.367 and statistically significant at 1 percent for models 1a and 1b respectively. This supports that there is a long-run causal relationship amongst the variables being observed, and that the model corrects the previous disequilibrium at an approximated speed of 37 percent. The results are consistent with the cointegration test and the VECM results, which suggests that the variables have a long-run equilibrium relationship as the coefficient is negative and significant (see Tables 7 and 8). Further, the short-run results reflect that no short-run effect on GDP per capita would result from the main variables being analysed (LWAP, LFWAP, LSLE and SAV), as none of the coefficients are statistically significant. The results support that these variables have a long-run impact on GDP per capita, which suggests that changes in economic growth results from long-term policies that have been implemented that are associated with labour supply, education, and savings.

4.6. REGRESSION RESULTS: ARELLANO-BOND DIFFERENCE GMM

Further to the PMG estimation technique, the GMM estimator was applied to the dynamic panel data to assess whether it would yield similar results as the PMG estimator in order to increase the robustness and validity of the empirical study. The two-step difference GMM regression model was applied to the dynamic panel data. The dynamic panel data was assessed for serial correlation and none was noted, as AR(2) was not statistically significant at 0.9998 and 0.9997 for models 1a and 1b respectively. The Sargan-Hansen test reviewed the J statistic and its associated probability (see Table 12). The test inferred that the variables are valid instruments in the regression.

The two-step difference GMM results

The summary of the regression results of the two models, 1a and 1b, are detailed in Table 12. The existence of the dynamics relationship in the model is noted through the lagged endogenous dependent variable of GDP per capita being positive and statistically significant at 1 percent.

This significant coefficient of the lagged GDP per capita allows for the inference that GDP per capita improves slowly over time as a result of previous period GDP per capita. The optimal lag length was based on the Schwarz information criterion that was determined as 3.

The three independent variables under investigation – labour supply, human capital and savings – are consistent with the observations noted from the PMG estimation discussed above. The labour supply proxies, LWAP and LFWAP, have negative and statistically significant relationships with GDP per capita. As reflecting an elasticity of -1.096 and -0.966 on GDP per capita in models 1a and 1b respectively, estimated by GMM *ceteris paribus*. The PMG coefficients were -0.654 and -0.572 for model 1a and 1b respectively, therefore it is reasonable to conclude that the relationships are consistent. It can also be observed that the human capital variables have a positive and statistically significant relationship with GDP per capita in models 1a and 1b, to the effect of 0.03 and 0.02 for LE and 0.61 and 0.69 for SLE respectively. This is in line with the PMG results that observed that the LE coefficient was 0.09 and 0.09 and SLE was 0.134 and 0.137 respectively for the two models. Finally, savings has a positive and statistically significant relationship with GDP per capita with a coefficient of 0.008 both models 1a and 1b. This is in line with the PMG results reflecting the savings coefficient being 0.003 for both models 1a and 1b. As the results of the GMM estimator being consistent with the PMG long-run estimation in this study, it is reasonable to conclude on the validity and robustness results of the study.

Further, it can be concluded that the GMM model was able to estimate the long-run relationships between the variables. This is unlike the study of Christopoulos et al. (2004), who were unable to conclude whether the GMM estimation results were a structural long-run equilibrium relationship or a spurious one.

Table 12: Sub-Saharan Africa two-step difference GMM estimation results (2000-2018)

| Dependent Variable is LPC_GDP | | | | | | |
|-------------------------------|---------------------|-------------|-------------|----------------------|-------------|-------------|
| | Model 1a | | | Model 1b | | |
| | Coefficient | t-Statistic | Probability | Coefficient | t-Statistic | Probability |
| LPC_GDP (-1) | 0.909598 *** | 12.14913 | 0.0000 | 0.890447 *** | 15.65224 | 0.0000 |
| LPC_GDP (-2) | -0.220949 *** | -7.226098 | 0.0000 | -0.218702 *** | -8.682770 | 0.0000 |
| LPC_GDP (-3) | 0.108657 *** | 3.563598 | 0.0010 | 0.097915 *** | 3.604120 | 0.0009 |
| LWAP | -1.096395 *** | -2.621111 | 0.0124 | | | |
| LFWAP | | | | -0.965985 ** | -1.998952 | 0.0526 |
| LE | 0.025165 ** | 2.276004 | 0.0284 | 0.023043 ** | 2.362820 | 0.0232 |
| LSLE | 0.611486*** | 2.667751 | 0.0111 | 0.693804 *** | 4.155032 | 0.0002 |
| SAV | 0.008171 *** | 7.302487 | 0.0000 | 0.008370 *** | 7.075435 | 0.0000 |
| LNR | 0.065681 ** | 2.279698 | 0.0282 | 0.061817 ** | 2.169399 | 0.0362 |
| LROL | -0.04627 | -1.199088 | 0.2377 | -0.042455 | -1.278625 | 0.2086 |
| LTAI | 0.028563 | 0.191309 | 0.8493 | 0.017402 | 0.115540 | 0.9086 |
| LTO | 0.036031 | 0.416668 | 0.6792 | 0.078725 | 0.848435 | 0.4014 |
| Hansen J Statistic | 32.96382 (0.324114) | | | 35.11625 (0.238435) | | |
| Arellano-Bond AR (2) | -0.000254 (0.99998) | | | -0.000385 (0.9997) | | |
| Countries | 40 | | | 40 | | |
| Observation | 533 | | | 533 | | |

Note: LPC_GDP= log per capita Gross Domestic Product; LSLE= log School Life Expectancy; LE= Life Expectancy; LWAP= log Working Age Population; LFWAP=log Female Working Age Population; SAV=Savings as a percentage of GDP; LNR=log Natural Resources Rent as a percentage of GDP; LROL=log Rule of Law; LTAI=log Technology Achievement Index; LTO= log Trade Openness. ***, ** and * denotes significance at 1 percent, 5 percent, and 10 percent respectively. Source: Author's own compilation from research data.

4.7 SUB-REGIONAL ESTIMATION

The sub-regional estimation for the four regions was performed using the fixed effect panel least squared estimation. Due to the data construct, the below estimations could not be applied:

1. GMM: the cross-sectional data for the sub-region are all less than the time period of the study, therefore T is greater than N for the all the sub-regions.
2. PMG: for all the sub-regions with the exception of WA, the cross-sectional data were less than the instruments, being the independent and control variables.
3. OLS Random Effect: similar to PMG, Random Effect requires that cross-sectional data be greater than the instruments, therefore the Hausman test could not execute on the data.

Based on the above, the most appropriate estimation technique was therefore deemed to be the OLS Fixed Effect. As can be seen from Table 13, each sub-region has its own dynamics due to the level of development. What can be clearly observed is the erratic and low GDP per capita throughout the region, most specifically in West Africa (see Annexure 3).

(i) Labour supply

Table 13 reflects that an increase of 1 percent in log of working age population (LWAP) and log of female working age population (LFWAP) has an elasticity effect of only increasing the log of GDP per capita by 0.65 and 0.60 at a statistically significant level of 0.05 and 0.10 respectively in Southern Africa. These results infer that working age population has only a 60 to 65 percent impact on GDP per capita. This has been a missed opportunity for Southern Africa for the past 15 years, as the region's demographic dividends window opened since 2003. Bloom et al. (1998) observed that in East Asia, there was a 1.46 increase in log of GDP per capita as a result of the increase in working age population. In order to yield demographic dividends through an increased labour supply, said supply needs to be in productive employment. The Southern Africa sub-region had an unweighted 20 percent unemployment rate during the period of 2000-2018, which was far higher than the 3 percent experienced in East Asia during their demographic dividends period. The impact of unemployment of labour supply is dire and has resulted in lower correlation than East Asia.

Southern Africa has invested in and spent significant resources over the past decades to improve human capital in the form of education and health, only to have a substantial portion of the working age population not increasing the sub-region's economic output.

East Africa's results show that an increase of 1 percent in log of LWAP and log of LFWAP has a negative elasticity effect on the log of GDP per capita by -0.55 and -0.56 at a statistically significant level of 0.10. These results are consistent with the findings noted by Kelley and Schmidt (1994), who concluded that in less developed countries have a negative relationship between GDP per capita and labour supply.

(ii) Human capital

Education

The slight improvement in school life expectancy (LSLE) during the 19-year period under observation in this study had a positive and statistically significant elasticity effect of 0.46 and 0.47 on GDP per capita in model 1a and 1b respectively in Middle Africa. With the improvement in school life expectancy having a positive impact on GDP, it implies that the human capital advancements made to date are having a positive impact on economic growth, which is consistent with the Bloom et al. (1998) which observed education having a 0.22 impact on GDP per capita.

Health

East Africa's log of life expectancy (LLE) has a positive and statistically significant effect on the log of GDP per capita, with an elasticity impact of 2.40 and 2.42 respectively in models 1a and 1b. This is consistent with the literature discussed in section 4.5. East Africa's life expectancy was 67 in 2018, up from 58 in 2000. This improvement has allowed the region to experience a significantly positive impact on GDP per capita.

Southern Africa is reflecting a negative relationship between life expectancy and GDP per capita, with an elasticity effect of -0.03 for both models 1a and 1b. With the region having a high unemployment rate, the improvements in increasing life expectancy from 49 in 2000 to 62 in 2018 has not had a significant positive impact on GDP per capita, as a substantial portion of the population is not productive. This is consistent with Gad (2021), who concluded that unemployment is a waste of human capital within the population.

The following control variables are statistically significant with GDP per capita:

(iii) Natural resources

Middle Africa's log of natural resources (LNR) has a positive and statistically significant effect on the log of GDP per capita, with an elasticity impact of 0.41 in models 1a and 1b. These findings are particularly interesting as a vast amount of literature points to Africa experiencing a resource curse, due to natural resources having a negative impact on economic growth (Sachs et al. 2001; Badeeb et al. 2017; Tabash et al. 2022). Abidin (2001) observed that a group of countries, including Chile, Oman, Botswana, Thailand and Malaysia, were able to escape the resource curse. Bravo-Ortega et al. (2002) noted that natural resource abundance has a positive relationship with economic growth when there is improved human capital. This study's findings of a positive impact on economic growth could therefore be due to the improvement in human capital in the Middle Africa sub-region.

(iv) Trade openness

East Africa's log of trade openness (LTO) has a positive and statistically significant effect on log of GDP per capita of 0.07 on both models 1a and 1b. This positive impact is consistent with observations made by Brueckner (2015) that there is a significant positive relationship between trade openness and economic growth in SSA. The GDP in the long run had a cumulative effect of an improvement of 2 percent on GDP. Sach et al. (1995) also concluded that trade openness has a 4.49 percent positive impact on economic growth.

(v) Technology advancements

Southern Africa has a positive and statistically significant relationship at significance level of 1 percent between technology advancements and GDP per capita, and an increase of 1 percent of technology advancements has a 0.5 elasticity effect on GDP per capita. In Middle Africa, there is an elasticity effect of 0.4 at a statistically significance of 10 percent *ceteris paribus*. Çaliskan (2015) noted that technology is able to increase output with the same level of inputs in a production process, which makes countries more competitive, while Fagerberg (1994) suggested that variation in countries' incomes is due to differences in productivity, with technology being key.

Table 13: Sub-regional fixed effect estimation results (2000-2018)

| Dependent Variable is LPC_GDP | | | | | | | | | |
|-------------------------------|---------------|--------|--------------|--------|----------------------|--------|--------------|--------|--|
| | Model 1a | | Model 1b | | Model 1a | | Model 1b | | |
| | Coefficient | prob>t | Coefficient | prob>t | Coefficient | prob>t | Coefficient | prob>t | |
| Southern Africa | | | | | Middle Africa | | | | |
| LPC_GDP(-1) | 0.647588*** | 0.0000 | 0.641302*** | 0.0000 | 0.738639*** | 0.0000 | 0.738743*** | 0.0000 | |
| LWAP | 0.645275** | 0.0509 | | | 0.655538 | 0.3859 | | | |
| FWAP | | | 0.597002* | 0.0614 | | | 0.600402 | 0.4347 | |
| LSLE | 0.016218 | 0.6815 | 0.016127 | 0.6840 | 0.461087** | 0.0467 | 0.468218** | 0.0431 | |
| LLE | -0.029002 *** | 0.0001 | -0.027636*** | 0.0001 | -0.023000 | 0.5824 | -0.020146 | 0.6356 | |
| LSAV | -0.034366 | 0.3186 | -0.033378 | 0.3360 | -0.009808 | 0.7530 | -0.009266 | 0.7663 | |
| LNR | 0.015929 | 0.5839 | 0.023783 | 0.4019 | 0.411211*** | 0.0000 | 0.411636 *** | 0.0000 | |
| LROL | -0.157751 | 0.1181 | -0.158254 | 0.1192 | -0.045228 | 0.5544 | -0.049336 | 0.5189 | |
| LTO | -0.046592 | 0.6018 | -0.046482 | 0.6049 | -0.020029 | 0.8181 | -0.016853 | 0.8463 | |
| LTAI | 0.500428 *** | 0.0000 | 0.506189*** | 0.0000 | 0.404750* | 0.0575 | 0.406361* | 0.0618 | |
| Adjusted R-squared | 0.983613 | | 0.983561 | | 0.989917 | | 0.989891 | | |
| Durbin-Watson stat | 1.621242 | | 1.616359 | | 2.117190 | | 2.114498 | | |
| East Africa | | | | | West Africa | | | | |
| LPC_GDP(-1) | 0.681045 *** | 0.0000 | 0.682868*** | 0.0000 | 0.809803*** | 0.0000 | 0.809418*** | 0.0000 | |
| LWAP | -0.548262* | 0.0928 | | | -0.197921 | 0.3609 | | | |
| FWAP | | | -0.556082* | 0.0846 | | | -0.199981 | 0.3649 | |
| LSLE | 0.575553 | 0.1196 | 0.594203 | 0.1089 | 0.078785 | 0.5214 | 0.077583 | 0.5267 | |
| LLE | 2.395415*** | 0.0044 | 2.421987*** | 0.0040 | -0.029385 | 0.1267 | 1.091389 | 0.1075 | |
| LSAV | 0.012270 | 0.8129 | 0.015965 | 0.7596 | -0.029385 | 0.1267 | -0.029409 | 0.1264 | |
| LNR | -0.049531 | 0.2442 | -0.051281 | 0.2220 | 0.004483 | 0.8753 | 0.005177 | 0.8555 | |
| LROL | -0.113049 | 0.2087 | -0.101438 | 0.2441 | 0.027078 | 0.6481 | 0.026693 | 0.6528 | |
| LTO | 0.065558 ** | 0.0425 | 0.066474** | 0.0381 | -0.043709 | 0.4275 | -0.045315 | 0.4140 | |
| LTAI | 0.948713 | 0.1895 | 0.877744 | 0.2113 | 0.025934 | 0.6851 | 0.026223 | 0.6828 | |
| Adjusted R-squared | 0.984205 | | 0.984224 | | 0.971371 | | 0.971369 | | |
| Durbin-Watson stat | 1.653061 | | 1.656054 | | 2.022956 | | 2.022051 | | |

Note: LPC_GDP= log per capita Gross Domestic Product; LSLE= log School Life Expectancy; LE= Log Life Expectancy; LWAP= log Working Age Population; FWAP=log Female Working Age Population; LSAV=log Savings as a percentage of GDP; LNR=log Natural Resources Rent as a percentage of GDP; LROL=log Rule of Law; LTAI=log Technology Achievement Index; LTO= log Trade Openness. ***, ** and * denotes significance at 1 percent, 5 percent and 10 percent respectively.

Source: Author's own compilation from research data

4.8 CONCLUSION

The results of the regression testing show that there is a statistically significant relationship between GDP per capita and the components of demographic dividends, being labour supply, human capital and savings. In SSA, the labour supply variables have a negative impact on GDP due to the impact of unproductive labour supply, caused by unemployment and low levels of human capital investment in the population. This study therefore fails to reject the null hypothesis that there is a positive relationship between labour supply and economic growth in SSA.

Human capital has a positive relationship with GDP per capita, thus if the region uses the opportunity to improve its human capital, this will have a ripple effect of improving the ability of the population to participate in productive work and increase income earnings. This will result in reduced unemployment, enabling the region to realise the benefit of having a large working age population and a large female working age population. The savings impact on GDP per capita will improve substantially once there is a substantial decline in the dependency ratio, as consumption expenditure in relation to income will be reduced as the working age population will acquire quality human capital this will allow the population to participate in productive labour. This would result in a greater part of the population generating increased earnings, allow for the ability to save. Based on the evidence of the study, there is a positive relationship between savings, human capital, and economic growth in SSA therefore I reject the second null hypothesis.

The regression analysis on the sub-regions within SSA reflect mixed relationships between the independent variables and GDP per capita. In Southern Africa, the results reflect an undesirable observation, as it has a significantly large working age population that is not in productive employment and therefore not contributing to economic enhancement. Significant rapid change is required to correct the current conditions in order to avoid low economic growth, which may result in stagnation and even deteriorate towards the state of Malthusian stagnation, where the population lives at subsistence level. The rest of the other three sub-regions should learn from Southern Africa and ensure that they do not follow a similar fate as they progress towards their demographic dividends window in the coming decade. Based on the current results, each of the sub-regions has only one statistically significant variable of the five main variables, highlighting that there is still significant policy progress required in order to position SSA to yield demographic dividends in the coming decades.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

SSA is going through a demographic transition, which is resulting in an increase in the working age population that will continue into the next couple of decades. This presents an opportunity for the region to improve its GDP per capita, similar to regions that were able to capitalise on their large working age populations, such as East Asia. The improvement of GDP per capita is associated with improving standards of living of a population, sustainable economic growth and more investment in policies and activities that will allow the region to meet the AU Agenda 2063 and potentially some of the SDGs.

This research study added to the existing body of knowledge on demographic dividends by applying an appropriate econometric model to identify the statistically significant influence (positive and negative) on GDP per capita resulting from labour supply, human capital, and savings in the context of Sub-Saharan Africa. The outcome of this study is intended to assist in providing policy directions for policy makers and governments in Sub-Saharan Africa, with the intention of improving and capitalising on this once-off opportunity to yield demographic dividends.

5.2 CONCLUSION

SSA has many social ills that need to be addressed, hence all the SDG goals are applicable to the region, as is the AU Agenda 2063. These goals can largely be addressed when there is an increase in sustainable economic activity in the region. The region is in the fortunate position of having an abundance of labour supply, yet governments and policy makers need to equip their populations with quality health and education. A significant amount of effort and resources need to be invested in human capital in order for the region to succeed. As highlighted in this research paper, the region has not started to benefit from having a growing working age population when compared to other regions that have experienced similar demographic transitions. SSA is in a fortunate position that the increase in working age population is still in the initial to mid stages, therefore there is still the opportunity to change course in respect to the quality of human capital. Policy makers and governments have time to self-correct and improve policy execution in order to make the most of this rare opportunity. The education pillar is in particular critical, as that is where the most significant gap exists. As per various studies, talent is key in the 21st century, as it enables innovation and competitiveness. Talent is

created and enhanced through education, which is the most transformative tool that will assist shape the region. Education will also assist in reducing unemployment amongst the working age population.

The other determinant of human capital is life expectancy, which is just 62 years in SSA which is less than the retirement age of 65 years. This means that the economy loses out on two to three years of an individual's life that could be contributing towards economic output for the region. The last determinant of demographic dividends is savings, which increase as the income levels of the region increase. Simultaneously, a decline in the dependency ratio results in less resources being allocated to consumption. The significant impact of savings materialises once the first demographic dividend is achieved.

5.3 POLICY RECOMMENDATIONS

The findings of this study present a bleak picture for the region. The following policies are recommended to create an environment where significant economic growth can be experienced, and demographic dividends reaped:

Education: the region is in need of policies that will improve the quality of education. This includes the investment in, and monitoring of, teaching skills; increasing the number of qualified teachers to allow for improved learning experiences such as quality face-to-face contact; improving access to quality teaching of STEM subjects, as these are a catalyst for innovation and improvement in technology advancements; increasing access to teaching resources such as laboratories, internet connectivity and libraries to allow for broader knowledge; and increasing access to adequately funded and well-functioning schools within close proximity of learners to afford them a well-rounded quality education.

Health: on average, the region has implemented fairly progressive policies related to health, yet healthcare still needs to be improved. Better health outcomes will improve both human capital and the quality and quantity of labour supply. Countries need to continue providing access to quality health care to its citizens in order to continue improving life expectancy beyond retirement age.

Savings: with the increase in working age population and the potential increase in economic participation of this population group as human capital increases, the region requires policies that support and motivate savings for asset accumulation and retirement. This can be done

through savings incentives such as limited risk savings schemes; increase access to financial institutions in area where the population resides that provide savings facilities; and providing attractive tax benefits to the working age population through tax deductions and rebates to support savings and asset accumulation.

The overriding requirement to these proposed policies is accountability. The region's leaders need to understand and appreciate their responsibility to their people and be accountable, utilising every cent for the betterment of the population. Without accountability and ethics there will be no appropriate execution of policies and there will be incorrect utilisation of the resources of the region.

5.4 AVENUES FOR FUTURE RESEARCH

The region is still in the early stage in terms of the demographic dividends window, therefore there is still time to track the progress of the region and its sub-regions in relation to demographic dividends. There is an opportunity for additional research to be performed over the coming decades, given SSA's data limitations, particularly around human capital. With the introduction of the LAYS and HCI metrics by reliable data sources such as the World Bank, these will highlight any progress in the region and allow for a more reasonable and accurate analysis of the relationships between the metric and economic growth. For example, LAYS is likely to yield a much more accurate estimation of the impact of education as it takes into account the quality and quantity of education, rather than existing studies that observe the impact of education through the quantity of education, i.e., mean years of study or school life expectancy.

REFERENCES

- Abbas, S. (2014). Trade liberalization and its impact on economic growth on developing and least developed countries. *Journal of International Trade Law and Policy*, 13(3), 215-221.
- Abidin, M. Z. (2001). Competitive Industrialization with Natural Resource Abundance: Malaysia. Resource Abundance and Economic Development. *Oxford, Oxford University press*.
- Ackah, C. (2008). For richer or poorer: trade policy and growth in developing countries. Paper Prepared for the UNECA Ad-hoc Expert Group Meeting on Macroeconomic Policy Productive Capacity and Growth in Africa, Addis Ababa, Ethiopia.
- African Union. (2022). African Economic Outlook 2022.
<https://www.afdb.org/en/documents/african-economic-outlook-2022-highlights>.
- Amedu, A.N., & Ngawu, U.G. (2022). The Impact of Trade Openness on Economic Growth: A Comparative Study of Selected West Africa Countries (1986- 2016). *Journal of Economics Education and Entrepreneurship*, 3(2), 151-163.
- Angrist, N., Djankov, S., Goldberg, P., & Patrinos, H. (2021). Measuring human capital using global learning data. *Nature*, 592(7854), 403-408.
- Arellano, M. (2003). *Panel Data Econometrics*. Oxford: Oxford University Press.
- Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29-51.
- Badeeb, R.A., Lean, H.H., & Clark, J. (2017). The evolution of the natural resource curse thesis: a critical literature survey. *Resources policy*, 51, 123-134.
- Baerlocher, D., Parente, S.L., & Rois-Neto, E. (2021). Female labor force participation and economic Growth: Accounting for the gender bonus. *Economic letters*, 200, 109740-109744.
- Bahrini, R. & Qaffas, A.A. (2019). Impact of Information and Communication Technology on Economic Growth: Evidence from Developing Countries. *Economies*, Vol.7 (1), p.21.
- Baltagi, B.H., Griffin, J.M., & Xiong, W. (2000). To Pool or Not To Pool: Homogeneous Versus Heterogeneous Estimators Applied to Cigarette Demand. *Review of Economics and Statistics*, 82(1), 117-126.

- Barro, R.J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 106(2), 407-443.
- Barro, R., & Lee, J.E. (1993). International comparisons of educational attainment. *Journal of Monetary Economics*, 32(3), 363-394.
- Becker, G.S., Glaeser, E.L., & Murphy, K.M. (1999). Population and economic growth. *The American Economic Review*, 89(2), 145-149.
- Becker, S.O., Cinnirella, F., & Woessmann, L. (2012). The effect of investment in children's education on fertility in 1816 Prussia. *Cliometrica*, 6(1), 29-44.
- Benhabib, J., & Spiegel, M.M. (1994). The role of human capital in economic development. *Journal of Monetary Economics*, 34(2), 143-173.
- Birdsall, N., Kelley, A.C., & Binding, S.W. (2001). *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*. Oxford: Oxford University Press.
- Blanchard, O.J. (1985). Debt, deficits, and finite horizons. *Journal of Political Economy*, 93(2), 223-247.
- Bloom, D.E., Cafiero-Fonseca, E., McGovern, M.E., Prettnner, K., Stanciole, A., Weiss, J., Bakkila, S., & Rosenberg, L. (2014a). The macroeconomic impact of non-communicable diseases in China and India: Estimates, projections, and comparisons. *The Journal of the Economics of Ageing*, 4, 100-111.
- Bloom, D.E., & Canning, D. (2000). The health and wealth of nations. *Science*, 287(5456), 1207-1209.
- Bloom, D.E., & Canning, D. (2009). Population health and economic growth. *Commission on growth and Development -The World Bank*, 53-75.
- Bloom, D.E., Canning, D., Fink, G., & Finlay J.E. (2009). Fertility, female labor force participation, and the demographic dividend. *Journal of Economic Growth*, 14(2), 79-101.
- Bloom, D.E., Canning, D., & Sevilla, J. (2003). The demographic dividend: a new perspective on the economic consequences of population change. *Published by Rand Corporation*.
- Bloom, D.E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development*, 32(1), 1-13.

- Bloom, D.E., & Freeman, R.B. (1986). The effects of rapid population growth on labor supply and employment in developing countries. *Population and Development Review*, 72(3), 381-414.
- Bloom, D.E., Kuhn, M., & Prettner, K. (2017). Africa's prospects for enjoying a demographic dividend. *Journal of Demographic Economics*, 83(1), 63-76.
- Bloom, D.E., & Williamson, J.G. (1998). Demographic transitions and economic miracles in emerging Asia. *World Bank Economic Review*, 12(3), 419-455.
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.
- Brander, J.A., & Dowrick, S. (1994). The role of fertility and population in economic growth. *Journal of Population Economics*, 7(1), 1-25.
- Bravo-Ortega, C., & de Gregorio, J. (2002). *The Relative Richness of the Poor? Natural Resources, Human Capital and Economic Growth*. Central Bank of Chile Working Paper No. 139.
- Brueckner, M., & Lederman, D. (2015). Trade Openness and Economic Growth: Panel Data Evidence from Sub-Saharan Africa. *Economica*, 82(s1), 1302-1323.
- Bucci, A. (2015). Product proliferation, population, and economic growth. *Journal of Human Capital*, 9(2), 170-197.
- Bucci, A., Carbonari, L., & Trovato, G. (2019). Health and Income: Theory and Evidence for OECD Countries. *Human Capital and Economic Growth*, 169-207.
- Bucci, A., & La Torre, D. (2009). Population and economic growth with human and physical capital investments. *International Review of Economics*, 56(1), 17-27.
- Caliskan, H.K. (2015). Technological Change and Economic Growth. *Social and Behavioral Sciences*, 195, 649-654.
- Carrion-I-Silvestre, J.L. (2005). Health care expenditure and GDP: are they broken stationary? *Journal of Health Economics*, 24(5), 839-854.
- Cavalcanti, T., Mohaddes, K., & Raissi, M. (2011). Growth, development and natural resources: new evidence using a heterogeneous panel analysis. *The Quarterly Review of Economics and Finance*, 51(4), 305-318.
- Cavalcanti, T., & Tavares, J. (2016). The Output Cost of Gender Discrimination: A Model-Based Macroeconomic Estimate. *The Economic Journal*, 126(590), 109-134.

- Cervellati, M., & Sunde, U. (2011). Life expectancy and economic growth: The role of the demographic transition. *Journal of Economic Growth*, 16(2), 99-133.
- Chauvet, L., & Collier, P. (2004). *Development effectiveness in fragile states: spillovers and turnarounds*. Oxford: Centre for the Study of African Economies, Department of Economics, Oxford University.
- Coale, A., & Hoover, E. (1958). *Population Growth and Economic Development in Low Income Countries*. Princeton, NJ: Princeton University Press.
- Crespo Cuaresma, J., & Lutz, W. (2007). Human Capital, Age Structure and Economic Growth: Evidence from a New Dataset. Retrieved from: <https://pure.iiasa.ac.at/8444>.
- Crespo Cuaresma, J., Danylo, O., Fritz, S., McCallum, I., Obersteiner, M., See, I., & Walsh, B. (2017). *Scientific reports, 2017, Vol.7 (1)*, 40678-40678.
- Creswell, J. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. City: SAGE Publications.
- Christopoulos, D.K., & Tsionas, E.G. (2004). Financial Development and Economic Growth: Evidence from Panel Unit Root and Cointegration Tests. *Journal of Development Economics*, 73(1), 55-74.
- Cuberes, D., & Teignier, M. (2014). Gender inequality and economic growth: a critical review. *Journal of International Development*, 26(2), 260-276.
- Currie, J., Stabile, M., Manivong, P., & Roos, L.L. (2010). Child health and young adult outcomes. *Journal of Human Resources*, 45(3), 517-548.
- Desai, M., Fukuda-Parr, S., Johansson C., & Sagasti F. (2002). Measuring the Technology Achievement of Nations and the Capacity to Participate in the Network Age. *Journal of Human Development*, 3(1), 96-122.
- Fagerberg, J. (1994). Technology and International Differences in Growth Rates. *Journal of Economic Literature*, 32(3), 1147-1175.
- Fawaz, F., Mnif, A., & Popiashvili, A. (2021). Impact of governance on economic growth in developing countries: a case of HIDC vs. LIDC. *Journal of Social and Economic Development* 23, 44-58.
- Filmer, D., Rogers, H., Angrist, N., & Sabarwal, S. (2020). Learning-adjusted years of schooling (LAYS): Defining a new macro measure of education. *Economics of education review*, Vol.77, 101971.

- Fincher, C.L., Thornhill, R., Murray, D.R., & Schaller, M. (2008). Pathogen prevalence predicts human cross-cultural variability in individualism/collectivism. *Proceedings of the Royal Society B: Biological Sciences*, 275(1640), 1279-1285.
- Gad, A.Y. (2021). The impact of education to the transition from unemployment to employment in Egypt. *Review of Economics & Political Science* 2631-3561.
- Galor, O. (2005). From Stagnation to Growth: Unified Growth Theory. *Handbook of Economic Growth*, 1, 171-293.
- Galor, O. (2011). *Unified Growth Theory*. Princeton, NJ: Princeton University Press.
- Galor, O., & David, M.F. (2004). *Food for Thought: Basic Needs and Persistent Educational Inequality*. Unpublished dissertation, Brown University.
- Galor, O., & Weil, D. (1996). The Gender Gap, Fertility, and Growth. *American Economic Review*, 86(3), 374–387.
- Galor, O., & Weil, D. (1999). From Malthusian Stagnation to Modern Growth. *American Economic Review, Papers and Proceedings*, 89(2), 150-154.
- Galor, O., & Weil, D.N. (2000). Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond. *The American Economic Review*, 90(4), 806-828.
- Gani, A. (2011). Governance and growth in developing countries. *Journal of economic issues*, 45(1), 19-40.
- Gemmell, N. (1996). Evaluating the impacts of human capital stocks and accumulation on economic growth: some new evidence. *Oxford Bulletin of Economics and Statistics*, 58(1), 9-28.
- Glewwe, P. (1999). Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco. *The Journal of Human Resources*, 34(1), 124-159.
- Gonzales, C., Jain-Chandra, S., Kochhar, K., Newiak, M., & Zeinullayev, T. (2015). Catalyst for Change: Empowering Women and Tackling Income Inequality. *SDN 15/20 IMF publication*.
- Gylfason, T., & Zoega, G. (2003). Education social equality and economic growth: a view of the landscape. *CESifo Economic Studies*, 49(4), 557-579.
- Gylfason, T., & Zoega, G. (2006). Natural Resources and Economic Growth: The Role of Investment. *World Economy*, 29(8),1091-1115.

- Haggard, S., & Tiede, L. (2011). The Rule of Law and Economic Growth: Where are We? *World Development*, 39(5), 673-685.
- Hanushek E.A., & Woessmann, L. (2012). Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. *Journal of Economic Growth*, 17(4), 267-321.
- Headey, D.D., & Hodge, A. (2009). The Effect of Population Growth on Economic Growth: A Meta-Regression Analysis of the Macroeconomic Literature. *Population and Development Review*, 35(2), 221-248.
- Howitt, P. (2005). Health, human capital, and economic growth: A Schumpeterian perspective. *Health and Economic Growth*,. MIT Press, ISBN 0-262-62212-2,19-40.
- Huang, T., & Xie, Z. (2013). Population and economic growth: a simultaneous equation perspective. *Applied Economics*, 45(27), 3820-3826.
- Hurd, M., McFadden, D., & Gan, L. (1998). Subjective Survival Curves and Life- Cycle Behavior. *Published by University of Chicago Press ISBN 0-226-90303-6*.
- Hussin, A., Nor'Aznin, A.B., & Sallahuddin, H. (2010). Analysis of FDI inflows to China from selected Asean countries: a panel cointegration approach. *Paper presented at International Economic Conference on Trade and Industry (IECTI)*.
- Idrees, A.S., & Siddiqi, M.W. (2013). Does public education expenditure cause economic growth? Comparison of developed and developing countries. *Pakistan Journal of Commerce and Social Sciences*, 7(1), 174-183.
- International Labour Office. (1996). *Economically Active Population 1950- 2010*. Geneva: International Labour Office.
- International Monetary Fund. (2014). *Africa Rising: Harnessing the Demographic Dividend*. IMF working paper 14/143.
- Jamison, D.T., Wang, K., Hill, K., & Londono, J.L. (1996). Income, Mortality and Fertility in Latin America: Country-Level Performance, 1960- 1990. *Revista de Andlisis Econmico*, 11, 219-261.
- Jayachandran, S., & Lleras-Muney, A. (2009). Life expectancy and human capital investments: Evidence from maternal mortality declines. *Quarterly Journal Economics*, 124(1), 349-397.
- Jayadevan, C.M. (2021). Impacts of health on economic growth: evidence from structural equation modelling. *Asia-Pacific Journal of Regional Science*, 5(2), 513-522.

- Karras, G. (2003). Trade openness and economic growth: Can we estimate the precise effect? *Applied Econometrics and International Development*, 3(1), 7-25.
- Kaufmann, D., Kraay A., & Zoido P. (1999). Governance matters. World Bank policy research working paper no. 2196.
- Kaufmann, D., & Kraay, A. (2019). *WGI Dataset*, *The World Bank Group, The Worldwide Governance Indicators (WGI) project*. Retrieved from: <http://info.worldbank.org/governance/wgi/#home>.
- Kelley, A.C., & Schmidt, M.R. (1994). *Population and income change: Recent evidence*. World Bank D Paper No. 249.
- Kelley, A.C., & Schmidt, M.R. (2005). Evolution of recent economic-demographic modelling: A synthesis. *Journal of Population Economics*, 18(2), 275-300.
- Kennedy, P. (2008). *A guide to econometrics*. Malden, MA: Blackwell Publishing.
- Ketokivi, M., & McIntosh, C.N. (2017). Addressing the endogeneity dilemma in operations management research: Theoretical, empirical, and pragmatic considerations. *Journal of Operations Management*, 52, 1-14.
- Kinugasa, T. (2004). *Life expectancy, labour force, and saving*. (Unpublished Ph.D. dissertation.) University of Hawaii at Manoa.
- Kiviet, J.F., Pleus, M., & Poldermans, R.W. (2017). Accuracy and Efficiency of Various GMM Inference Techniques in Dynamic Micro Panel Data Models. *Econometrics* 5(1), 14-68.
- Knowles, S., Lorgelly, P.K., & Owen, P.D. (2002). Are educational gender gaps a brake on economic development? Some cross-country empirical evidence. *Oxford Economic Paper*, 54(1), 118-149.
- La Porta, R., & Shleifer, A. (2014). Informality and Development. *Journal of Economic Perspectives*, 28(3), 109-126.
- Lee, R., & Mason, A. (2010). Some macroeconomic aspects of global population aging. *Demography*, 47(Suppl.), 151-172.
- Lee, R., Mason, A., & Miller, T. (2000). Life Cycle Saving and the Demographic Transition: The Case of Taiwan. *Population and Development Review*, 26(0), 194-219.
- Lorentzen, P., McMillan, J., & Wacziarg, R. (2008). Death and development. *Journal of Economic Growth*, 13(2), 81-124.

- Loayza, N., & Ranciere, R. (2006). Financial development, financial fragility, and growth. *Journal of Money, Credit and Banking*, 38(4), 1051-1076.
- Madsen, J.B. (2016). Health, human capital formation and knowledge production: Two centuries of international evidence. *Macroeconomic Dynamics*, 20(4), 909-953.
- Mason, A. (2005). *Demographic transition and demographic dividends in developed and developing countries*. Retrieved from:
<https://www.un.org/en/development/desa/population/events/pdf/expert/9/mason.pdf>
- Mason, A., & Kinugasa, T. (2008). East Asian economic development: two demographic dividends. *Journal of Asian Economics*, 19(5), 389-399.
- Mason, A., Lee, R., & Jiang, J.X. (2016). Demographic dividends, human capital, and saving. *The Journal of the Economics of Ageing*, 7, 106-122.
- Mason, A., & Miller, T. (1998). Family and intergenerational income transfers in Taiwan. In K.O. Mason, N.O. Tsuya, & M.K. Choe (eds.). *The Changing Family in Comparative Perspective: Asia and the United States*. Honolulu: East-West Center, 215-236.
- Matos, S., & Silvestre, B.S. (2013). Managing stakeholder relations when developing sustainable business models: the case of the Brazilian energy sector: Sustainable Innovation and Business Models. *Journal of Cleaner Production*, 45, 61-73.
- McCoskey, S.K., & Selden, T.M. (1998). Health care expenditures and GDP: panel data unit root test results. *Journal of Health Economics*, 17(3), 369-376.
- Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the Resource Curse. *The Economic Journal*, 116(508), 1-20.
- Mierau, J.O., & Turnovsky, S.J. (2014). Demography, growth, and inequality. *Economic Theory*, 55(1), 29-68.
- Mishra, V., & Smyth, R. (2010). Female Labor Force Participation and Total Fertility Rates in the OECD: New Evidence from Panel Cointegration and Granger Causality Testing. *Journal of Economics and Business*, 62(1), 48-64.
- Narayan, P.K. (2006). Examining structural breaks and growth rates in international health expenditures. *Journal of Health Economics*, 25(5), 877-890.
- Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Buellton Economic Statistics*, 61(Special Issue), 653-678.

- Pedroni, P. (2004). Panel cointegration: asymptotic and finite samples properties of pooled time series tests with an application to the PPP hypothesis. *Economic Theory*, 20, 597-625.
- Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Pesaran, M.H., Yongcheol, S., & Ron, P.S. (1999). Pooled Mean Group Estimation and Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*, 94(446), 621-634.
- Piketty, T. (2014). *Capital in the Twenty-First Century*. Cambridge, MA: Harvard University Press.
- Porter, M.E. (1990). *The Competitive Advantage of Nations*. New York: Free Press, MacMillan.
- Porter, M., Sachs, J., & McArthur, J. (2002). Executive summary: Competitiveness and stages of economic development.
<http://sdnbd.org/sdi/issues/economy/ExecSumm-competitiveness-ranking-2001.pdf>
- Porter, M., Schwab, K., X Sala-i-Martin, X., & Lopez-Claros, A. (2004). *Global Competitiveness Report*. London: Palgrave Macmillan.
- Pritchett, L. (2013). The rebirth of education: Schooling ain't learning. *CGD Books Asian-Pacific Economic Literature*, 28(2), 107-110.
- Roberts, M.R., & Whited, T.M. (2012). *Endogeneity in empirical corporate finance*. Simon School Working Paper No. FR 11-29.
- Robinson, J.A., Torvik, R., & Verdier, T. (2006). Political foundations of the resource curse. *Journal of Development Economics*, 79(2), 447-468.
- Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, 9(1), 86-136.
- Rostow, W.W. (1960). *The Stages of Economic Growth: A Non-communist Manifesto*. Cambridge: Cambridge University Press.
- Rothwell, J. (2013). The hidden STEAM economy. *Metropolitan policy program at Brookings*.
<https://www.brookings.edu/wp-content/uploads/2016/06/thehiddenstemeconomy610.pdf>

- Rubin, A., & Babbie, E. (2010). *Research methods for social work*. Belmont, CA: Brooks/Cole.
- Sachs, D.J., & Warner, A.M. (2001). The curse of natural resources. *European Economic Review*, 45(4), 827-838.
- Sachs, D.J., Warner, A.M., Aslund, A., & Fischer, S. (1995). Economic reforms and the process of global integration. *Brookings Papers on Economic Activity*, 1995(1), 1-118.
- Safiullin, N.Z., & Safiullin, B.L. (2018). Static and dynamic models in economics. *International Conference Information Technologies in Business and Industry PTS 1-4*, 1015(3), 32117-32124.
- Sahay, R., & Bredenkamp, H. (2015). Rethinking Financial Deepening: Stability and Growth in Emerging Markets. *Revista de Economía Institucional*, 17(33).
- Samargandi, N., Fidrmuc, J., & Ghosh, S. (2015). Is the Relationship between Financial Development and Economic Growth Monotonic? Evidence from a Sample of Middle Income Countries. *World Development*, 68(1), 66-81.
- Schmidt, R.M., & Kelley, A.C. (1996). Saving, dependency and development. *Journal of Population Economics*, 9(4), 365-386.
- Schwab, K. (2019). *The Global Competitiveness Report*. World Economic Forum. Retrieved from: https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf.
- Sethy S.K., & Sahoo, H. (2015). Investigating the Relationship between Population and Economic Growth: An Analytical Study of India. *Indian Journal of Economics and Business*, 14(2), 269-288.
- Solow, R.M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economic*, 70(1), 65-94.
- Solow, R.M. (1985). Economic history and economics . *The American economic review*, Vol.75 (2),328-331.
- Strauss, J., & Thomas, D. (1998). Health, Nutritional and Economic Development. *Journal of Economic Literature*, 36(2), 766-817.
- Tabash, M., Mesagan, E.P., & Farooq, U. (2022). Dynamic linkage between natural resources, economic complexity, and economic growth: Empirical evidence from Africa. *Resources Policy*, 78, 102865.
- Tahir, M., & Azid, T. (2015). The relationship between international trade openness and economic growth in the developing economies Some new dimensions. *Journal of Chinese Economic and Foreign Trade Studies*, 8(2),123-139.

- Thornton, J. (2001). Population Growth and Economic Growth: Long-Run Evidence from Latin America. *Southern Economic Journal*, 68(2), 464-468.
- Tumwebaze, H.K., & Ijjo, A.T. (2015). Regional Economic Integration and Economic Growth in the COMESA Region, 1980-2010. *African Development Review*, 27(1), 67-77.
- Ullah, S., Akhtar, P., & Zaefarian, G. (2018). Dealing with endogeneity bias: The generalized method of moments (GMM) for panel data. *Industrial Marketing Management*, 71, 69-78.
- UNCTAD. (2006). World investment report 2006. FDI from developing and transition economies: Implications for development. <https://unctad.org/webflyer/world-investment-report-2006>
- UNESCO. (2019). Global education monitoring report. https://en.unesco.org/gem-report/sites/default/files/OOSC_press_release.pdf
- UNESCO.(2021) The persistent teacher gap in sub-Saharan Africa is jeopardizing education Recovery. <https://www.unesco.org/en/articles/persistent-teacher-gap-sub-saharan-africa-jeopardizing-education-recovery>
- United Nations. (2004). World population to 2300. Department of Economic and Social Affairs, Population Division. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Jan/un_2002_world_population_to_2300.pdf
- United Nations. (2019). World Population Prospects 2019. Department of Economic and Social Affairs, Population Division. <https://www.un.org/development/desa/pd/news/world-population-prospects-2019-0>
- United Nations. (2022). World Population Prospects 2022. Department of Economic and Social Affairs, Population Division. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf
- Weil, D.N. (2007). Accounting for the effect of health on economic growth. *Quarterly Journal of Economics*, 122(3),1265-1306.
- Williamson, J.G., & Higgins, M. (2001). The accumulation and demography connection in Eastern and South- Eastern Asia. In A. Mason (ed.). *Population Change and Economic Development in Eastern and South-eastern Asia: Challenges Met, Opportunities Seized*. Stanford: Stanford University Press, 123-154.










- Wintoki, M.B., Linck, J.S., & Netter, J.M. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, 3(105), 581-606.
- World Bank Group. (2020). The Human Capital Index 2020 UPDATE. Human Capital in the Time of COVID-19.
<https://documents1.worldbank.org/curated/en/456901600111156873/pdf/The-Human-Capital-Index-2020-Update-Human-Capital-in-the-Time-of-COVID-19.pdf>
- World Economic Forum. (2019). The Global Competitiveness Report 2019.
https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf
- World Health Organisation. (2002). Health, economic growth, and poverty reduction. *The p report of working group 1 of the commission on macroeconomics and health*.
<https://apps.who.int/iris/bitstream/handle/10665/42492/9241590092.pdf?sequence=1>
- Yao, W., Kinugasa, T., & Hamori, S. (2013). An empirical analysis of the relationship between economic development and population growth in China. *Applied Economics*, 45(33), 4651-466.
- Yoo, P. (1994). Boom or bust? The economy effects of the baby boom. *Review - Federal Reserve Bank of St. Louis*, Vol.76 (5), 13-22.

ANNEXURE 1: SUB-SAHARAN AFRICAN COUNTRIES

Western Africa

| | |
|---|--|
| 1.  Benin | 2.  Guinea-Bissau * |
| 3.  Burkina Faso | 4.  Liberia * |
| 5.  Cabo Verde | 6.  Mali |
| 7.  Cameroon | 8.  Mauritania |
| 9.  Côte d'Ivoire | 10.  Niger |
| 11.  Equatorial Guinea | 12.  Nigeria |
| 13.  Gabon * | 14.  São Tomé and Príncipe * |
| 15.  Gambia | 16.  Senegal |
| 17.  Ghana | 18.  Sierra Leone |
| 19.  Guinea | 20.  Togo |

Southern Africa

| | |
|---|--|
| 1.  Botswana | 2.  South Africa |
| 3.  Eswatini | 4.  Malawi * |
| 5.  Lesotho | 6.  Zambia |
| 7.  Mozambique | 8.  Zimbabwe |
| 9.  Namibia | |

Middle Africa

| | |
|---|---|
| 1.  Angola | 2.  Congo |
| 3.  Burundi | 4.  Democratic Republic of the Congo |
| 5.  Central African Republic | 6.  Rwanda |
| 7.  Chad | |

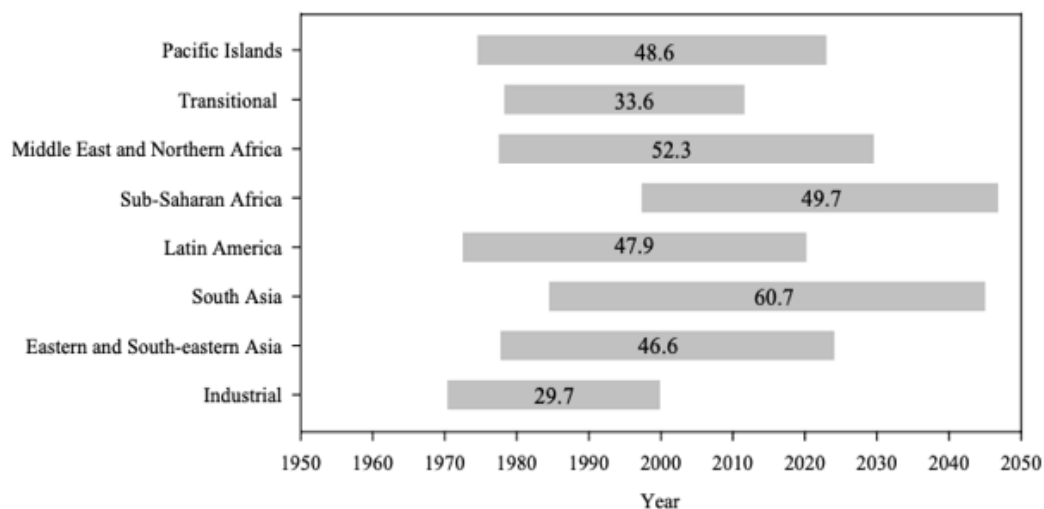
Eastern Africa

| | |
|---|---|
| 1.  Comoros | 2.  Seychelles |
| 3.  Eritrea * | 4.  Somalia * |
| 5.  Ethiopia | 6.  South Sudan * |
| 7.  Kenya | 8.  Sudan |
| 9.  Madagascar | 10.  United Republic of Tanzania |
| 11.  Mauritius | 12.  Uganda |

Source: World Bank (2022)

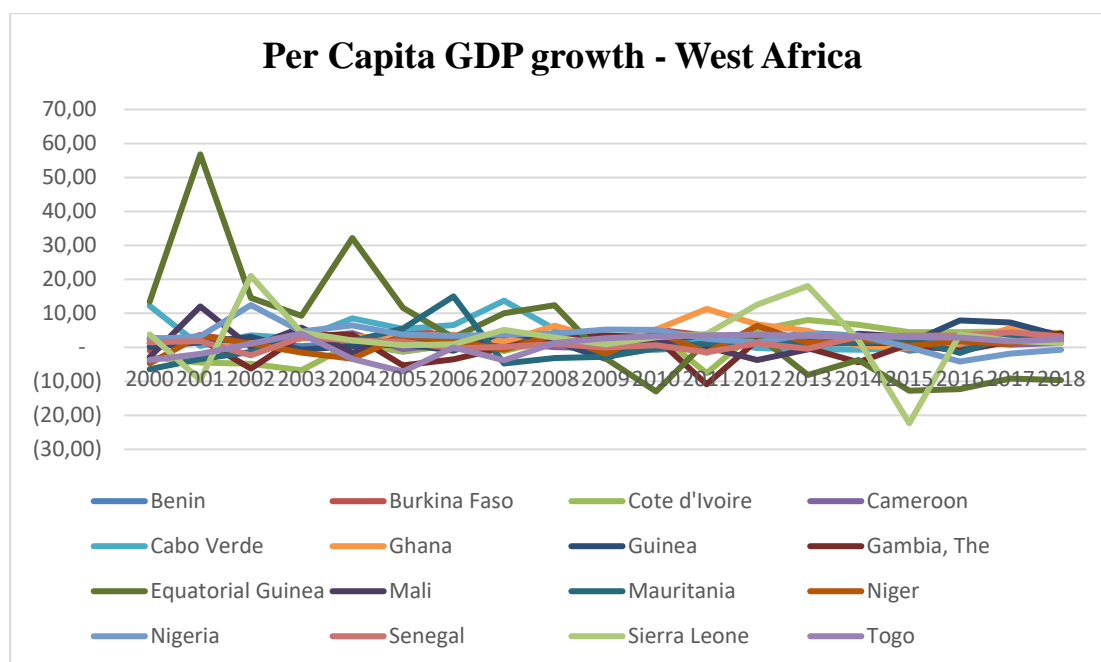
*Countries excluded from regression analysis due to the individual countries having inadequate data for the period being observed.

ANNEXURE 2: TIMING OF FIRST DEMOGRAPHIC DIVIDENDS IN SELECTED REGIONS



Source: Masson (2005)

ANNEXURE 3: GDP PER CAPITA GROWTH WEST AFRICA



Source: World Bank (2022)