# POPULATION DYNAMICS AND HUMAN CAPITAL DEVELOPMENT IN WEST AFRICA

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*ABSTRACT*

*The global population, which stood at 7.7 billion in 2019, is projected to reach 9.7 billion in 2050; and thereafter peak at about 11 billion in 2100. West Africa, the fastest growing (2.69%) sub-region in sub-Saharan Africa and the second largest in the region after East Africa, constitutes 5.07% of the global population figure. By 2050, the third largest country in the world – Nigeria – will emerge from West Africa. All these have far-reaching implications for economic outcomes, sustainable development activities and human capital development in the sub-region. Currently, the progress achieved in human capital development in West Africa appears very low compared to other parts of the world. This study investigated the role of population dynamics in human capital development in West Africa over the period 1990–2017, covering 15 countries. Three human capital measures — life expectancy, primary school completion and secondary school enrolment rates — were employed as regressands with the static panel data modelling approach, using fixed effects (FE) and random effects (RE) estimators. However, the Hausman test result was significant, implying the appropriateness and consistency of FE. The findings overwhelmingly revealed that population dynamics is a drag on human capital development in West Africa. This is evident in the negative and statistical significance reported for most of the coefficients of demographic variables. In view of this, policy enactment and implementation should focus on measures to reduce adolescent fertility, population ages 0–14, and the death rate. Specifically, education, particularly for girls, is a powerful weapon that can reduce adolescent and total fertility, and also contribute to* *declining population ages 0–14. Investment in health facilities and infrastructure, the provision of free/affordable medical care for children and women will improve their health status and reduce mortalities.*

JEL classification: J11, J13, J24, O15

## 1. Introduction

The global population, which was 7.7 billion in 2019, is projected to reach 9.7 billion in 2050 before it peaks at about 11 billion by 2100 (United Nations, 2019). Presently, sub-Saharan Africa (SSA) accounts for 13.82% of the world's population, with approximately 1.1 billion people, which is growing at 2.66% based on data from the World Population Review (2019). West Africa, the fastest growing (2.69%) sub-region in SSA and the second largest in the region, after East Africa, constitutes 5.07% of global population figures. By 2050, the third largest country globally will emerge from West Africa, which implies that the sub-region will contribute substantially to global population figures with its attendant consequences.

The growth and size of a society's population is affected by its dynamics; birth rate, death rate and other factors operate to influence the demographic pattern of a nation. Thus, aside from net migration, the most important determinants of population growth are the birth (influenced by fertility), and death rates (Bloom, 2019), which in turn affect the entire population size. These give rise to a pattern of demographic structure in which the proportions of children, youth and the elderly, which all form the dependent population and the working class, continue to change with "different rates of fertility, morbidity and mortality, population growth, urbanization, and internal and international migration" (United Nations Department of Economic and Social Affairs, UNDESA and United Nations Population Fund, UNFPA, 2012, 3).

Population dynamics describe "changes in the numbers, age class distribution, sex ratio, and behaviour of a population through time and space, determined by inherent characteristics of the individuals and mediated by environmental conditions, food resources, and interacting biotic agents" (Ferris and Wilson, 1987, 372). According to UNDESA & UNFPA (2012, 3), population dynamics have to do with "changes in population growth rates, age structures and distributions of people." It manifests in the changing patterns of dependency and fertility rates, birth and death rates, population composition and growth. These have far-reaching implications for economic outcomes, sustainable development activities, environment, human capital development, provision of healthcare services, urbanization, savings, investment, and capital formation (see Birdsall and Griffin, 1993; Kang, 1994; Bloom, Canning and Malaney, 2000; Kelley and Schmidt, 2005; Tobing, 2012; Dauda and Aziakpono, 2015; Cruz and Ahmed, 2018; Weber and Sciubba, 2019).

Marked changes have been observed in the trend of demographic variables across West Africa over the years. Statistics from the World Bank (2020) reveal declines in mortality rates (death rate; infant, under-five and maternal mortalities), fertility and birth rates while population size generally remains high. However, compared to achievements elsewhere, the performance of West Africa with respect to changes in these variables still lags behind most of the sub-regions in SSA and outside Africa. For instance, while mortality rates in the majority of countries in North Africa and other regions of the world are approaching a single digit, the same cannot be said of West Africa where such figures still remain double and in some of its countries, triple digits (see World Bank, 2020). Moreover, all categories of age dependency ratios and fertility rates remain very high. These have the capacity to influence economic variables such as growth, per capita income, savings, investment, development, and human capital negatively.

Literature abounds with studies on how demographic changes and variables affect economic outcomes. However, not much attention has been given to the human capital implications of population dynamics. In fact, literature along this line is very scarce in West Africa, as it appears that most demographic research neglect this important issue. For instance, available works focus on demographic dividend (Bloom, Canning and Sevilla, 2003; Dauda and Aziakpono, 2015; Olaniyan et. al, 2018); demographic changes and economic growth (see Bloom, Canning and Malaney, 2000; Akintunde, Olomola and Oladeji, 2013; Sánchez-Romero, Abio, Patxot and Souto, 2018); effect of demographic variables on development, poverty and inequality (see Birdsall and Griffin, 1993; Ahlburg, 1996; Crenshaw, Ameen and Christenson, 1997; Abernethy, 2002; UNFPA, 2002; Klasen and Woltermann, 2005; Yip et al., 2017), and how demographic changes impact health as well as the environment (Getzen, 1992; Shaw, 1992;

Speidel, Weiss, Ethelston and Gilbert, 2007, 2009; de Meijer, Wouterse, Polder and Koopmanschap, 2013; Weber and Sciubba, 2019).

Demographic changes have the capacity to influence human capital development. For instance, high fertility coupled with a large population size, whether at the household level or national level, can have negative impact on education, health and nutrition, while low fertility and a moderate population size can enhance these variables (see Cincotta and Engelman, 1997; Fertig, Schmidt and Sinning, 2009; Casterline, 2010). Countries across the world with moderate population growth, declines in fertility and mortality have recorded appreciable progress in human capital development through deliberate policy enactment.

The progress achieved in human capital development in West Africa appears very low compared to the heights attained in other parts of the world. For example, school enrolments (secondary and tertiary in particular) remain abysmally low, literacy rate has not improved substantially, public expenditure on health and education are below expectation while health outcomes such as infant, under-five and maternal mortality rates are high in addition to very low physician density. The latest human capital index released by the World Bank (2020) shows West African countries performing poorly, with the majority of them being at the lowest ebb. For example, 7 out of the 16 countries in the sub-region fall among the first 9 worst countries. The best country in the sub-region, Ghana, scored 0.439 (43.9%) out of 1.00 (100%) followed by Senegal, which recorded 41.8 percent while the least country, Niger scored 31.6%. Similarly, average life expectancy in the sub-region, although fluctuating, has been rising gradually over the years as shown in figure 1. The mean value as at 2017 was around 54 years. This notwithstanding, country-specific performance showed some of the countries crossing the 60 years threshold while none of the nations has reached 70 years.

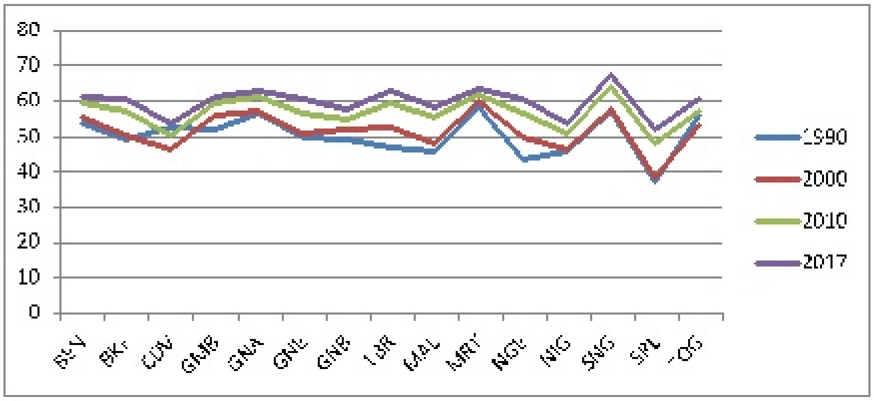


**Figure 1.** Average Life Expectancy at Birth in West African Countries, 1990–2017.

BEN– Benin; BKF– Burkina Faso; CDV– Côte d'Ivoire; GMB– Gambia; GNA– Ghana; GNE–Guinea; GNB–Guinea–Bissau; LBR–Liberia; MAL–Mali; MRT–Mauritania, NGE–Niger, NIG–Nigeria; SNG–Senegal; SRL–Sierra Leone; TOG–Togo.

*Source:* Generated by Author from World Bank (2020).

Although several factors are responsible for the poor performance of West Africa in human capital development, the impact of population dynamics cannot be explained away. Figures 2–4 present information on different demographic variables in West Africa. Figure 2 shows the fertility trend in countries of the sub-region. Apparently, fertility rate remains high in almost all the countries in West Africa, with Niger, having the highest rate while Ghana has the least. Generally, the variable has maintained a declining trend across all countries in the sub-region since 1990, nevertheless, the rate as at 2017 remained well above 4 births per woman except in Ghana, which had 3.93.

The high rate of fertility has contributed to bloated birth rate in West Africa. A look at figure 3, which shows birth rate in the sub-region reveal that birth per 1,000 population is above 30 in all the countries. Niger has the highest with 55.57 and 47.84 in 1990 and 2017 respectively.

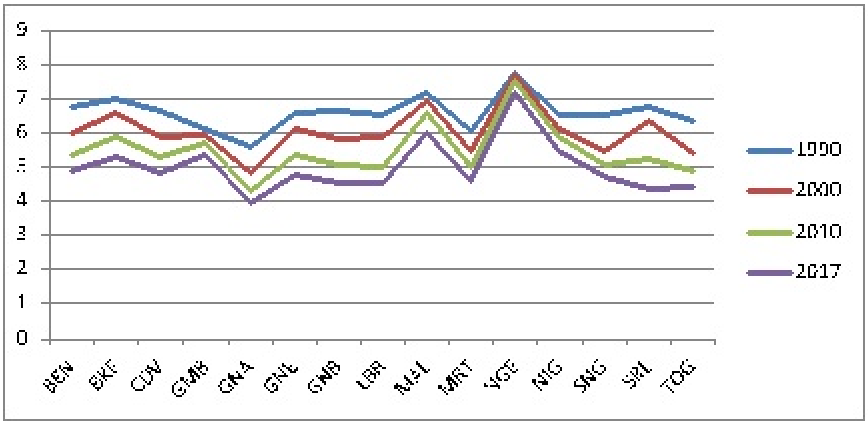


**Figure 2.** Fertility Rate in West Africa, 1990–2017.

BEN– Benin; BKF– Burkina Faso; CDV– Côte d'Ivoire; GMB– Gambia; GNA– Ghana; GNE–Guinea; GNB–Guinea–Bissau; LBR–Liberia; MAL–Mali; MRT–Mauritania, NGE–Niger, NIG–Nigeria; SNG–Senegal; SRL–Sierra Leone; TOG–Togo.

*Source:* Generated by Author from World Bank (2020).

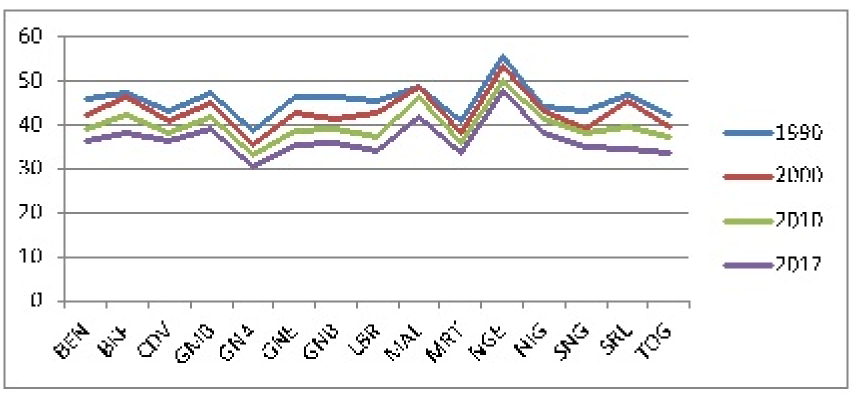


**Figure 3.** Birth Rate Per 1,000 People in West Africa, 1990–2017.

BEN– Benin; BKF– Burkina Faso; CDV– Côte d'Ivoire; GMB– Gambia; GNA– Ghana; GNE–Guinea; GNB–Guinea–Bissau; LBR–Liberia; MAL–Mali; MRT–Mauritania, NGE–Niger, NIG–Nigeria; SNG–Senegal; SRL–Sierra Leone; TOG–Togo.

*Source:* Generated by Author from World Bank (2020).

Similarly, high fertility and birth rates account for a large army of young population in West Africa, which could enhance economic performance if appropriate policies are put in place to invest in their education and other facilities as well as youth empowerment programmes. As indicated in figure 4, population ages 0–14 as a percentage of total population is very high, with most of the countries except Ghana and Mauritania recording well above 40%. This would have been of benefit if greater attention were concentrated on human capital development.

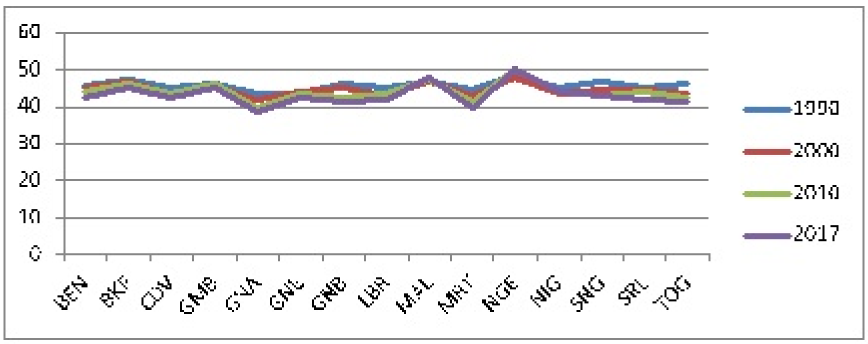


**Figure 4.** Population Ages 0–14 as Percentage of Total Population, 1990–2017.

BEN– Benin; BKF– Burkina Faso; CDV– Côte d'Ivoire; GMB– Gambia; GNA– Ghana; GNE–Guinea; GNB–Guinea–Bissau; LBR–Liberia; MAL–Mali; MRT–Mauritania, NGE–Niger, NIG–Nigeria; SNG–Senegal; SRL–Sierra Leone; TOG–Togo.

*Source:* Generated by Author from World Bank (2020).

From the foregoing, the performance of West Africa in human capital development vis-à-vis population dynamics is not encouraging. High fertility and birth rates, which have contributed to high population of young persons, are capable of militating against human capital development thereby serving as a drag on sustainable development (SD) in the sub-region if the right policies are not adopted. It is based on this that this study assesses how population dynamics affect human capital development in West Africa. This diverges from previous studies that focus mainly on how demographic changes affect economic growth and development.

The rest of the paper is structured thus: section 2 focuses on the review of related literature, section 3 shows the methodology guiding the study, section 4 presents the results of the empirical analysis performed in the study, while section 5 concludes the study with policy recommendations.

## 2. Literature Review

### 2.1 Theoretical issues

The work of Malthus was the major attempt at examining the economic implications of demographic changes in the society. It laid the foundation upon which most demographic studies are built. The theory presents a pessimistic view of population growth impact on economic outcomes. It presupposes that an "upsurge in population that out-passes means of subsistence would not only produce adverse effects on economic outcomes but could be detrimental to human survival" (Dauda and Aziakpono, 2015, 118) and increase poverty level.

Although events such as advancements in technology, which are applied in all sectors including agriculture for high yields, improvement in health, arising from development in public health infrastructure and vaccines to prevent diseases, may appear to have cast some doubts on the theory; empirical evidence, however, coupled with current happenings around the planet may suggest that Malthus was not totally wrong. Even the demographic transition theory, which argues that as fertility and mortality decline, dependency ratio will decrease, and labour force will be boosted, thereby resulting in rising output per capita and "improved economic growth and development" (Dauda and Aziakpono, 2015, 118) drew inspiration from the Malthusian population theory. As the population of the world grows, the activities of man have continued to impact the planet, leading to resource depletion and scarcity, environmental degradation, global warming, outbreak of diseases, and so on (see Pentland, 2011; Kaacka and Katulc, 2013; Peura, 2013; and Mbella, Oumar and Baye, 2019).

The study of demographic changes/population dynamics within the context of these theories holds three dissenting views. The first follows the line of argument of Malthus, which sees population growth as a drag on economic benefits and societal well-being (see Crenshaw, Ameen & Christenson, 1997; Ashraf & Galor, 2008; Lorentzen, McMillan & Wacziarg, 2008; Weil & Wilde, 2009; Chaparro & Kulkarni, 2015; Peterson, 2017). The second argument presupposes that declining fertility and mortality with the requisite human capital investment will favour high working age groups and lower dependency ratio; which will in turn raise per capita income level, boost economic growth and development and enhance the standard of living in the society (see Kelley & Schmidt, 1995, 2005; Crenshaw et al., 1997; Snowdon, 2008; Furuoka, 2009;

Weil & Wilde, 2009; Cervellati & Sunde, 2011; Chaparro & Kulkarni, 2015). The third view reveals that demographic changes, particularly population growth neither enhances economic prosperity nor depresses it, as empirical findings turned out statistically insignificant (see Kapuria-foreman, 1995; Prskawetz et al., 2007; Adenola & Saibu, 2017). Commenting on this stance, Kelley and Schmidt (1995, 543) observed that "more than a dozen studies using cross-country data fail to establish any "statistically significant association between the growth rates of population and of per capita output."

Apart from their influence on economic outcomes such as growth and development, demographic changes/population dynamics are critical for human capital development. Household size determined by the rates of fertility, birth, mortality and death will affect the health status, nutrition, training and education of the offspring. Children in large families tend to be malnourished due to low per capita income while school enrolment and completion tend to be low and performance in school is negatively affected (Cincotta & Engelman, 1997; Liu, 2017), particularly in developing countries where households are responsible for the education of their children. Thus, a household with few children can invest more in training their children, in the provision of healthcare and good nutrition, as well as make them to attain a high level of education.

Cincotta and Engelman (1997) contend that a country with rapid population growth will have very high proportions of school-age children, which will "put pressure on existing school and health care facilities", raise "national education budgets", and "depress public education expenditures per student." This argument is premised on economic theories of the household in which it is stressed that rapid population growth increases consumption at the expense of savings, investment and capital formation; and as the dependency rate of youth rises, more resources will be required to invest in education, health, infrastructure and employment (see Crenshaw, Ameen & Christenson, 1997; Browning, Chiappori & Weiss, 2014; Grossbard, 2015). The argument is that households take deliberate economic decision between the quantity (number) and quality (human capital) of children, to the extent that a quality–quantity trade-off exists at the household level regarding human capital decision (see Becker, 1960; Becker & Lewis, 1973; Hahn & Park, 2010). Thus, demographic changes strongly affect human capital formation.

Similarly, a population comprising a large number of elderly people (ageing population), as currently witnessed in some advanced economies of Europe and Asia, has implications for human capital investment. According to Fertig, Schmidt and Sinning (2009), investment in the education of the younger population may be affected negatively in an ageing society. This is informed by the decline in the labour force as old-age dependency ratio rises, which may impinge on the welfare of the society including educational attainment. Fertig and his colleagues however, noted that theoretically, there is some ambiguity with respect to the net effect of population ageing on human capital formation, particularly in the area of education among the younger population. For instance, in an ageing population situation, investment in the education of younger people may rise if a relative shift in labour supply leads to increase in young workers' wages, which is an indication of high returns to human capital investment. In the same vein, this might be counterbalanced by a decline in the labour force, which leads to decrease in labour market competition and youth unemployment.

Moreover, ageing population has contributed substantially to increases in health expenditure across countries in Europe, North America and Asia resulting from the need to cater for the health of the bloated number of the elderly, even in the face of high rate of old-age dependency ratio relative to the working population (see Mendelson & Schwartz, 1993; Nakanishi & Nakayama, 2001; Fukawa, 2007; Lopreite & Mauro, 2017). Thus, population dynamics matter for human capital development.

## 2.2 Empirical Literature

Extensive studies have been conducted on demographic variables and economic outcomes in developed and developing economies, using diverse methodologies (techniques of estimation, data sets and sources) and varieties of economic outcome variables across different periods of time. The motivation for these studies is the growing realization of the critical role of demographic transition in the economic prosperity of nations. The debate is an age long one since the period of Thomas Malthus, in which rising population was viewed as a drag on economic outcomes. However, the majority of these studies neglect the essential effects of dynamics of population on human capital and rather focus on other economic outcomes, which are mostly classified under demographic dividend or on how demographic variables affect economic growth, development, per capita income, poverty and inequality.

Among studies that focus on economic outcomes rather than human capital is the work of Crenshaw, Ameen and Christenson (1997), which examined how population dynamics influenced economic development, in a cross-national study covering 75 developing countries over the period 1965–1990. The authors employed the ordinary least squares (OLS) estimating technique for the specified model, which contains per capita GDP growth as the explained variable and population growth, labour force and age-specific population growth rates as explanatory variables. The findings revealed that the growth of children population depresses economic progress while increase in adult population enhances economic development. The effect of children population growth rate on per capita output was larger than that of the adult population, and therefore the positive impact of the adult population on growth could not compensate for the negative effect of the child population. The authors argued that because the growth rate of the adult population lagged behind that of the younger population, the youth dependency ratio was aggravated, which tends to impact negatively on growth and development. It is likely that the estimating technique employed by these authors might have informed the findings of their study. Using the OLS technique for a cross-country study may bias the findings because individual characteristics that are peculiar to each of the nations pooled together in the study cannot be captured by this estimating technique.

Motivated by the rapid growth experienced by some East Asian countries between 1965 and 1990, and given the fact that previous studies did not pay much attention to the influence of population on growth performance, Bloom, Canning and Malaney (2000) analysed the existing relationship between demographic variables and economic growth across 70 countries covering all regions of the world over the period 1965–1990, and using the static panel data approach, allowing bi-directional causality. The findings show that demographic influences played very prominent roles in the great economic successes achieved in the East Asian countries and the failures recorded in South Asia. It was further reported that higher income exerts strong negative influence on fertility rates with a very sharp declining trend in fertility between 1965 and 1990. Some of the demographic variables responsible for the performances as indicated in the study are “differences in health status, dependency burdens, and the spatial distribution and concentration of people" (Bloom, Canning & Malaney, 2000, 261).

Furthermore, declining fertility and mortality that favours higher working age group relative to age dependent population, given the appropriate policy, has been reported as contributing to demographic dividend across nations with substantial increase in productivity, employment generation and economic growth.

For instance, Bloom, Canning and Sevilla (2003) show that population age structure, which is influenced by changes in fertility and mortality rates is critical for economic performance. This is premised on the fact that the economic behaviour and the needs of people vary at different stages of life, and thus will influence economic performance. For instance, a country, which comprises large populations of the young and elderly relative to the working population, will devote a greater proportion of its income to catering for this set of people, and this may lower the pace at which the economy grows. On the other hand, an economy with a larger working age group than the younger and elderly population, with the right policies, will enjoy high productivity and demographic dividend that will enhance economic growth. As a matter of fact, "the combined effect of this large working-age population and health, family, labour, financial, and human capital policies can effect virtuous cycles of wealth creation" (Bloom, Canning and Sevilla, 2003, xi).

Akintunde, Olomola and Oladeji (2013) measured population dynamics using life expectancy and fertility in their study on SSA over the period 1970–2005 in a dynamic panel data model, and reported negative and positive effects of fertility and life expectancy on economic growth respectively. Using life expectancy (instead of mortality) and fertility may not capture population dynamics appropriately. Mortality variables instead of life expectancy, in addition to fertility, appear more appropriate. Although the authors claimed to have measured mortality with life expectancy, the justification for this was missing, because data are available on all forms of mortalities — infant, under-five, maternal — and death rates. Moreover, the use of OLS in addition to difference and system GMM to estimate a dynamic panel data model appears inappropriate because issues relating to auto-correlation due to the presence of a lagged dependent variable as one of the explanatory variables cannot be captured with OLS. Furthermore, the study reported Wald statistic for results generated from OLS estimation. This estimating technique does not report Wald statistic but F-statistic. Similarly, the negative effect of fertility on economic growth by the authors contrast with the findings of Dauda and Aziakpono (2015) in a cross-country study on West Africa, in which fertility along with labour force and population growth were found to enhance economic growth in West Africa between 1970 and 2011 while infant mortality caused a decline in growth.

Consistent with the findings of Dauda and Aziakpono (2015) is the work of Youssef, Elden and Ali (2018). The authors conducted a comparative study between Egypt and Morocco in North Africa (spanning 1965–2016) on the one hand and the Republic of Korea in Asia (spanning 1965–1995) on another hand, using correlation and OLS. The report indicated that working-age population enhanced per capita GDP growth in the two North African countries as witnessed in the Republic of Korea. The finding was explained by declining fertility and rising labour force as the dependency ratio fell in the countries.

Studies have also shown the strategic role human capital plays in the impact of demographic changes on economic outcomes. For instance, Lutz et al. (2019) revealed that changing age structure without investment in human capital cannot lead to economic growth. In their study, which employed a panel of 165 countries, spanning 1980–2015, to examine how changing age structure and increasing human capital can explain economic growth, it was found that demographic dividend, which is driven by human capital (education) contributes significantly to economic growth.

Moreover, some empirical works on demographic changes have incorporated human capital measures in their models, even though such studies did not focus strictly on human capital. Prominent among them is the work of Ali and Ahmad (2014), which tried to examine how socio-economic factors affect life expectancy in Oman. The authors included population growth among other variables such as food production, school enrollment, inflation, per capita income and $CO^2$ emissions as factors affecting life expectancy. The findings showed a negative and statistically significant impact of population growth on life expectancy.

Similarly, Bilas, Franc and Bosnjak (2014) analysed factors that determine life expectancy in 28 European Union countries between 2001 and 2011. The authors included population growth among other determinants (GDP growth rate, level of education attained, education enrolment, and per capita GDP). The result however, indicates that population growth does not have any significant impact on life expectancy. Chan and Devi (2015) considered the impact of demographic changes, socio-economic inequality, and the availability of health care resources on life expectancy in Singapore, Malaysia, and Thailand from 1980 to 2008 and reported positive effects of demographic changes on life expectancy through health care resources.

From the foregoing, the importance of demographic changes for economic growth and development has been well researched. However, little attention has been given to the role of demographic changes/population dynamics in human capital development, which is the focus of the present study.

## 3. Theoretical Framework and Methodology

The theoretical basis for this study is the human capital theory, and the model adopted derives from the human capital production functions of Ben Porath (1967) and Grossman (1972). Grossman focuses on health as a measure of human capital while Ben-Porath measures human capital from the perspective of education (Dauda, 2018). Thus, to develop or produce human capital, investments must be undertaken in health or education or both. This implies that there exists a production function for human capital development, which requires some input into the production process. So, according to Ben Porath (1967) and Grossman (1972), human capital is a form of commodity produced using some input combinations and at household level, individuals can invest in themselves, "thus producing a form of human capital with some input combinations in the human capital production function,…, which enhances and raises the individual worker's productivity" in the market and household sectors of the economy (Dauda, 2018, 6). Some of the inputs into human capital production cover social, economic, health, environmental and epidemiology variables.

### 3.1 Measures of human capital

Schultz (1961, 9) in his article identified specific means of human capital formation, which provide information on different measures of human capital. These are: investment in 'health facilities and services; "on-the-job" training; 'formally organized education at the elementary, secondary and higher levels; study programmes organized for adults by firms, "including extension programmes; and "migration of individuals and families to adjust to changing job opportunities." According to Dauda (2017), all activities focusing on "education, health, training, apprenticeship, migration policy, and special programmes to develop managerial capabilities" for the purpose of improving people's capacity to enhance their meaningful contributions to human development are relevant for human capital development. Therefore, measures of human capital include: education, health, training, apprenticeship, migration, study programmes for adults, and special programmes for managerial skill development.

In view of the above, different variables have been used in literature to measure human capital, particularly for empirical studies (see Barro, 1991; Mankiw, Romer and Weil, 1992; Sharpe, 2001; Acemoglu and Johnson, 2007; Cohen and Soto, 2007; Cohen and Leker, 2014). Some of these include school enrolment and completion rates, educational attainments, literacy rates, education expenditures, hospital beds per capita, health expenditures, infant mortality rate, life expectancy, net migration, incidence and length of work place training, number of doctors and other health care professionals per capita and so on. For this study, three human capital variables covering education and health were employed. These are life expectancy (human capital in the area of health), primary school completion rate (education measure of human capital), and secondary school enrolment rate (human capital in the area of education). The choice of education and health measures is informed by the central roles of both in human capital development and data availability.

In view of the above, human capital production function is given as:

$$HC = f(\boldsymbol{DM}\ \boldsymbol{HD}) \tag{1}$$

where: *HC* stands for human capital variable, ***DM*** captures demographic variables while ***HD*** implies other factors that affect human capital development.

### 3.2 Panel data econometric model specification

The study employs the static panel data model. A conventional static panel model could be specified as:

$$y_{it} = X'_{it}\beta + \varepsilon_{it} \qquad i = 1,..., n;\ t = 1,..., T \tag{2}$$

where $y_{it}$ stands for dependent variable for cross section unit (or country) $i$ at time $t$. The variable $X_{it}$ indicates the independent variables or regressors while $\varepsilon_{it}$ is the error term.

The term $\varepsilon_{it}$ can be decomposed into a one-way error component as:

$$\varepsilon_{it} = \mu_i + \nu_{it} \tag{3}$$

Or into a two-way error component as:

$$\varepsilon_{it} = \mu_i + \lambda_t + \nu_{it} \tag{4}$$

From equations (3) and (4), $\mu_i$ is the unobserved individual/cross-section/country specific effect, $\lambda_t$ denotes unobserved time effect and $v_{it}$ is the remaining disturbance term.

So, Equation (2) could be rewritten as:

$$y_{it} = X'_{it}\beta + \mu_i + \lambda_t + \nu_{it} \qquad i = 1,..., n;\ t = 1,..., T \tag{5}$$

In this study, $y_{it}$ represents human capital in country $i$ at time $t$ and $X_{it}$ stands for all the explanatory variables that determine human capital (including demographic variables) used in the study. Moreover, $i = 1, \ldots, N;$ and $t = 1, \ldots, T$. Similarly, $\nu_i$ is country specific effects, $\lambda_t$ denotes unobserved time effect while $\nu_{it}$ signifies stochastic disturbance term, with $\upsilon_i \sim IID(0.\sigma^2_{\upsilon})$, $\lambda_i \sim IID(0.\sigma^2_{\lambda})$ and $\nu_{it} \sim IID(0.\sigma^2_{\nu})$ independent of each other, among themselves and of explanatory variables (see Baltagi, 2005; Vijayamohanan, 2016).

### 3.3 Empirical model for the study

The study specified a semi-log model given as:

$$HC_{it} = \beta_0 + \beta_1 pp014_{it} + \beta_2 ppg_{it} + \beta_3 \ln gdpp_{it} + \beta_4 hivp_{it} + \beta_5 br_{it} + \beta_6 dr_{it} + \beta_7 fer_{it} + \beta_8 pp65_{it} + \beta_9 afer_{it} + \upsilon_i + \nu_{it} \tag{6}$$

where: *HC* implies human capital, measured as *lep* (life expectancy)*; pryc* (primary school completion rate); and *sec* (secondary school enrolment rate). Others include *ppo14,* which stands for population ages 0–14 as percentage of total population, *ppg* is population growth rate, *lngdpp* denotes log of per capita GDP, *hivp* is HIV prevalence, *br* means birth rate per 1,000 population, *dr* implies death rate per 1,000 population, *fer* is total fertility rate, *pp65* signifies population ages 65 and above as percentage of total population, and *afer* stands for adolescent fertility rate.

Per capita GDP represents the economic variable, HIV prevalence captures epidemiology factor, while the remaining variables are demographic. Data availability informed the choice of HIV prevalence over malaria. Moreover, prevalence of HIV in West Africa is above the 1% level threshold that formed a generalized epidemic. Life expectancy and per capita GDP were logged while others were not because they appear in rates and these were taken into consideration in the interpretation of results presented in section 4.

### 3.4 Techniques of estimation

Two static panel estimators were employed for analysis in this study. They are fixed effects (FE) and random effects (RE) estimators. To differentiate between the two, consider equation (4) specified as

$$\varepsilon_{it} = \mu_i + \lambda_t + \nu_{it}$$

where: $\mu_i$ is unobservable country heterogeneity; $\lambda_t$ is unobservable time heterogeneity, and $\nu_{it}$, the remaining error component.

The assumption guiding FE is that both $\mu_i$ and $\lambda_t$ are fixed parameters to be estimated while $\nu_{it}$ is "identically and independently distributed with zero mean and constant variance $\sigma^2_\nu$" (Vijayamohanan, 2016, 10), Whereas, RE assumes that $\mu_i$, $\lambda_t$ and $\nu_{it}$ are all random, which implies that the three are "identically and independently distributed with zero mean and constant variance."

### 3.5 Choice between FE and RE

The Hausman test was used to determine between FE and RE. The null hypothesis is that RE is consistent and efficient while the alternative hypothesis states that RE is inconsistent; which implies the consistency of FE. So, if ($p \leq 0.05$) then, FE will be preferred otherwise RE is preferred. In this study, the Hausman test supports FE as shown in tables 3–6.

### 3.6 Scope of the study

The study examines population dynamics and human capital development in West Africa over the period 1990–2017. It covers 15 countries, namely Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo. Cape Verde was omitted due to non availability of some data. Moreover, the study could not extend beyond 2017 because data for 2018 were not available on some variables.

### 3.7 Data and variables

Table 1 presents information on variables, their definitions and sources.

**Table 1.** Variables, Definitions and Sources

| Variables | Definitions | Sources |
|---|---|---|
| lep | Life expectancy at birth, total (years) | World Bank (2020) |
| ppo14 | Population ages 0–14 (% of total) | World Bank (2020) |
| ppg | Population growth (annual %) | World Bank (2020) |
| gdpp | GDP per capita, PPP (constant 2011 international $) | World Bank (2020) |
| hivp | Prevalence of HIV, total (% of population ages 15–49) | World Bank (2020) |
| br | Birth rate, crude (per 1,000 people) | World Bank (2020) |
| dr | Death rate, crude (per 1,000 people) | World Bank (2020) |
| fer | Fertility rate, total (births per woman) | World Bank (2020) |
| pp65 | Population ages 65 and above (% of total) | World Bank (2020) |
| afer | Adolescent fertility rate (births per 1,000 women ages 15–19) | World Bank (2020) |
| pryc | Primary completion rate, total (% of relevant age group) | World Bank (2020) |
| sec | School enrollment, secondary (% gross) | World Bank (2020) |

*Source:* Compiled by Author, 2020.

## 4. Empirical Results and Discussion

This section presents and discusses the empirical results of the analyses carried out in the study. They cover descriptive statistics and findings from panel econometric estimation. Table 2 shows descriptive statistics while tables 3–6 display outcomes of the estimations performed on the specified models, using both fixed effects and random effects techniques.

### 4.1 Descriptive statistics

Information on the measures of central tendencies and variability with respect to the variables used in the estimated models is presented in this section.

**Table 2.** Descriptive Statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| lep (years) | 420 | 54.11 | 5.89 | 35.71 | 67.48 |
| pp014 (%) | 420 | 44.57 | 2.18 | 38.52 | 50.23 |
| ppg (%) | 420 | 2.76 | 0.92 | –1.84 | 7.85 |
| gdpp (US$) | 420 | 1752.67 | 996.91 | 268.86 | 5687.59 |
| hivp (%) | 420 | 1.71 | 1.18 | 0.10 | 6.10 |
| br (per 1,000 people) | 420 | 41.72 | 4.82 | 30.52 | 55.57 |
| dr (per 1,000 people) | 420 | 13.19 | 4.07 | 5.75 | 27.54 |
| fer ((births per woman) | 420 | 5.82 | 0.83 | 3.93 | 7.77 |
| pp65 (%) | 420 | 2.92 | 0.33 | 2.30 | 3.82 |
| afer (births per 1,000 women aged 15–19) | 420 | 131.55 | 37.04 | 66.61 | 223.69 |
| pryc (%) | 269 | 51.34 | 19.74 | 13.46 | 100.24 |
| sec (%) | 238 | 27.94 | 15.22 | 6.204 | 69.95 |

*Source:* Computed by Author, 2020.

From the descriptive analysis presented in table 2, life expectancy in West Africa averaged 54.11 years. It however ranged between a minimum of 35.71 and a maximum of 67.48 years. Nevertheless, its spread from the average value stands at 5.89. The population of age-group 0–14 years as a percentage of the total population in the sub-region was 44.57% during the period of the study. This implies that the West African population still comprises a large number of young persons. Thus, more investment in the education of this group of persons will be required in the sub-region. In the same vein, the mean of population growth rate remained 2.76%. The per capita income of West Africa has been low over the years. As shown in the table, the average value of GDP per capita for the period 1990–2017 was US$1,752.67. This however, hovered between US$268.86 and US$5,687.59. HIV prevalence among the population aged 15–49 years averaged 1.71%, with the minimum and maximum values being 0.10% and 6.10% respectively. Birth and death rates in the sub-region appear high in addition to fertility rates as shown in the table. The average birth rate fluctuates between 30.52 and 55.57 while the average death rate during the study hovered between 5.75 and 27.54 per 1,000 people. Adolescent fertility is extremely high; 131.55 on average, with the minimum being 66.61 and the maximum 23.69 births per 1,000 women. This calls for concern, since the risks of child death and maternal deaths are always high in this situation, particularly in low-income regions like West Africa. Primary school completion and secondary school enrolment stood at 51.34 and 27.94 on average in that order.

### 4.2 Population dynamics and human capital development in West Africa: Empirical results

Findings from model estimations carried out in the study are presented in this sub-section. Three dependent variables (life expectancy, primary school completion rate and secondary school enrolment rate) that measure human capital were used, which translates into three models. In addition, the study employed two estimators, namely FE and RE. The implication is that each of the three models were estimated with two techniques or estimators. This further implies six models in all. The reason for this is to compare results and also to indicate transparency. However, the Hausman test, which was performed to decide between FE and RE supported FE. Tables 3–5 present results per model while table 6 shows a summary of the results of the three models comprising only FE findings due to its preference based on the Hausman test.

**Table 3.** Effects of Population Dynamics on Human Capital Development

Dependent Variable = Natural log of Average Life Expectancy

| Regressors | FE | RE |
|---|---|---|
| pp014 | –0.008*** | –0.009*** |
| | (0.000) | (0.000) |
| ppg | 0.002* | –0.0002 |
| | (0.069) | (0.848) |
| lngdpp | 0.023*** | 0.013*** |
| | (0.000) | (0.000) |
| hivp | –0.008*** | –0.009*** |
| | (0.000) | (0.000) |
| br | 9.63E–06 | 0.001 |
| | (0.992) | (0.280) |

| Regressors | FE | RE |
|---|---|---|
| dr | –0.026** | –0.027*** |
| | (0.000) | (0.000) |
| fer | 0.028*** | 0.031*** |
| | (0.000) | (0.000) |
| pp65 | 0.009*** | 0.006** |
| | (0.002) | (0.029) |
| afer | –0.0004*** | –0.0003*** |
| | (0.000) | (0.000) |
| Constant | 4.379*** | 4.481*** |
| | (0.000) | (0.000) |
| R-squared | 0.996 | 0.995 |
| Wald -Stat. | 1.83e+08*** | 31445.89*** |
| | (0.000) | (0.000) |
| Hausman Stat. | 26.51*** | |
| | (0.002) | |

*Note:* ***, **,* denote significance at 1%, 5% and 10% levels respectively while probabilities are in parenthesis

*Source:* Computed by Author

Table 3 presents the results of analysis performed using life expectancy as the dependent variable. The findings reveal that life expectancy and the population aged 0–14 years are inversely related as evident in the coefficients of both FE and RE. This implies that the population in the age group 0–14 years depress human capital given its negative value. A percentage rise in this population would reduce life expectancy significantly by 0.8% and 0.9% for the FE and RE results respectively. Population growth had a positive but marginally significant impact on life expectancy in the FE result while that of RE was negative and insignificant. The import of this is that population growth does not portend danger for human capital development in West Africa. This finding is consistent with the study by Bilas, Franc and Bosnjak (2014), which reported insignificant effect of population growth on life expectancy in 28 European Union countries between 2001 and 2011. However, Oman, Ali and Ahmad (2014) found negative and statistically significant impact of population growth on life expectancy.

GDP per capita had positive and significant effect on life expectancy in both estimations, showing that a 1% increase in per capita income would raise life expectancy by 0.023% and 0.013% for FE and RE in that order. This finding is consistent with the study conducted by Bilas, Franc and Bosnjak (2014) to determine factors that affect life expectancy in 28 European Union countries. The authors reported a positive and significant influence of per capita GDP on life expectancy in these countries. The prevalence of HIV is a drag on life expectancy, as a negative and statistically significant influence of the variable emerged from the analysis. This is consistent with the *a priori* expectation and the finding of Dauda (2018), which showed that HIV/AIDS impacts life expectancy negatively and significantly in West Africa. Moreover, studies have shown that HIV/AIDS has contributed not only to low life expectancy in SSA but has also broadened the gap between the region's and the global average (Anderson, 2010; Haacker, 2010; Dauda, 2018).

The impact of birth rate on life expectancy was positive but statistically insignificant in both estimations. However, death rate reduced life expectancy significantly with the coefficient being –0.026 and –0.027, given the outcomes of both FE and RE respectively. Fertility and population aged 65 and above exerted positive and significant impact on life expectancy. However, adolescent fertility depressed life expectancy by 0.04% and 0.03% for FE and RE results respectively.

The Hausman test result as indicated in the table was significant. This implies consistency of FE. The result of the Wald Chi-square test was also significant, meaning that the explanatory variables in the model are jointly significant.

**Table 4.** Effects of Population Dynamics on Human Capital Development

Dependent Variable = Primary School Completion Rate

| Regressors | FE | RE |
|---|---|---|
| pp014 | 0.802 | –0.981 |
| | (0.626) | (0.452) |
| ppg | –0.295 | –1.751 |
| | (0.812) | (0.145) |
| lngdpp | 18.764*** | 7.147* |
| | (0.003) | (0.051) |
| hivp | 5.977*** | 4.400*** |
| | (0.000) | (0.001) |
| br | 3.0796** | 3.043*** |
| | (0.041) | (0.009) |

| | | |
|---|---|---|
| dr | –2.941*** | –3.871*** |
| | (0.000) | (0.000) |
| fer | –31.027*** | –24.854*** |
| | (0.000) | (0.000) |
| pp65 | 12.400*** | 0.335 |
| | (0.007) | (0.934) |
| afer | –0.184 | –0.018 |
| | (0.135) | (0.827) |
| Constant | –55.435 | 106.159 |
| | (0.618) | (0.122) |
| R–squared | 0.821 | 0.803 |
| Wald –stat. | 17073.38*** | 577.10*** |
| | (0.000) | (0.000) |
| Hausman Stat. | 26.44*** | |
| | (0.002) | |

*Note:* ***, **,* denote significance at 1%, 5% and 10% levels respectively while probabilities are in parenthesis.

*Source:* Computed by Author (2020).

The results presented in table 4 show that in West Africa, the population of children aged 0–14, population growth rate and adolescent fertility had no significant relationship with primary school completion rate across the two specifications during the period 1990–2017. Per capita GDP, birth rate and population of persons within the age bracket 65 and above had positive and significant impact on primary school completion rate. However, the coefficients of per capita GDP and the population aged 65 and above as returned by the RE estimation were marginally significant and insignificant respectively. For instance, a 1% increase in per capita GDP would raise school completion by 0.19% while a unit rise in birth rate would increase school completion rate by 18.76 units, given the FE results. Moreover, the FE results also indicate that fertility depressed school completion significantly by 31.03 units while the coefficient of population aged 65 and above was 12.4, and statistically significant. Death rate had negative and statistically significant impact on primary school completion in West Africa as shown in the table. A unit rise in its value declined primary school completion by 2.94 and 3.87 for FE and RE respectively. The sign of the coefficient of HIV prevalence was counter-intuitive. The reason for this is not clear. The Hausman test result was statistically significant. Therefore, FE is preferred. Moreover, the Wald statistic was also significant, meaning that the explanatory variables were jointly significant.

**Table 5.** Effects of Population Dynamics on Human Capital Development

Dependent Variable = Secondary School Enrolment Rate

| Regressors | FE | RE |
|---|---|---|
| pp014 | –3.937** | –4.251*** |
| | (0.012) | (0.004) |
| ppg | 0.092 | –0.385 |
| | (0.943) | (0.779) |
| lngdpp | 0.323 | 10.772*** |
| | (0.957) | (0.002) |
| hivp | –3.115* | 1.359 |
| | (0.067) | (0.363) |
| br | 0.435 | 0.836 |
| | (0.760) | (0.487) |
| dr | –0.870 | –2.256*** |
| | (0.137) | (0.000) |
| fer | 1.497 | 0.134 |
| | (0.861) | (0.987) |
| pp65 | –12.697*** | –19.170*** |
| | (0.002) | (0.000) |
| afer | –0.685*** | –0.181** |
| | (0.000) | (0.021) |
| Constant | 318.160*** | 211.680*** |
| | (0.001) | (0.001) |
| R–Squared | 0.839 | 0.789 |
| Wald –Stat. | 5775.71*** | 364.08*** |
| | (0.000) | (0.000) |
| Hausman Stat. | 61.35*** | |
| | (0.000) | |

*Note:* ***, **,* denote significance at 1%, 5% and 10% levels respectively while probabilities are in parentheses.

*Source:* Computed by Author, 2020.

The findings shown in table 5 used secondary school enrolment rate as a measure of human capital. From the table, population aged 0–14 and 65 and above and adolescent fertility had negative and statistically significant impact on secondary school enrolment across both specifications (FE and RE). A unit rise in the number of persons within age bracket 0–14 reduced enrolment in secondary school by 3.94 and 4.25, as indicated by the coefficients of FE and RE respectively. Similarly, age bracket 65 and above depressed secondary school enrolment significantly by 12.70 and 19.17 units due to a unit increase in their number. Regarding adolescent fertility, a unit increase in its value reduced secondary school enrolment by 0.69 and 0.18 units for FE and RE outcomes respectively. Population growth and birth rate did not show any significant relationship with secondary school enrolment rate. Per capita GDP had positive relationship with secondary school enrolment rate across the two specifications; however, the result of FE was insignificant while that of RE was significant. With respect to death rate, the coefficients of both estimations were negative but only the one for RE was significant. The result of the Hausman test was significant; which is an indication of preference for FE. In addition, the right-hand-side variables used in the models were jointly significant going by the probability of the Wald statistic.

Table 6 presents the results of FE analysis across the three human capital measures employed in the study. This is to enable easy comparison of results across the three human capital measures, since the Hausman tests carried out supported FE across all models. Column 1 shows the explanatory variables contained in the models while columns 2, 3 and 4 show results using the dependent variables (human capital measures) of life expectancy (LEP), primary school completion rate (PRYC), and secondary school enrolment rate (SEC) respectively.

**Table 6.** Summary of FE Results across Human Capital Measures

| Regressors | LEP | PRYC | SEC |
|---|---|---|---|
| pp014 | –0.008*** | 0.802 | –3.937** |
| | (0.000) | (0.626) | (0.012) |
| ppg | 0.002* | –0.295 | 0.092 |
| | (0.069) | (0.812) | (0.943) |
| lngdpp | 0.023*** | 18.764*** | 0.323 |
| | (0.000) | (0.003) | (0.957) |
| hivp | –0.008*** | 5.977*** | –3.115* |
| | (0.000) | (0.000) | (0.067) |
| br | 9.63E–06 | 3.0796** | 0.435 |
| | (0.992) | (0.041) | (0.760) |
| dr | –0.026** | –2.941*** | –0.870 |
| | (0.000) | (0.000) | (0.137) |
| fer | 0.028*** | –31.027*** | 1.497 |
| | (0.000) | (0.000) | (0.861) |

| Regressors | LEP | PRYC | SEC |
|---|---|---|---|
| pp65 | 0.009*** | 12.400*** | –12.697*** |
| | (0.002) | (0.007) | (0.002) |
| afer | –0.0004*** | –0.184 | –0.685*** |
| | (0.000) | (0.135) | (0.000) |
| Constant | 4.379*** | –55.435 | 318.160*** |
| | (0.000) | (0.618) | (0.001) |
| R–Squared | 0.996 | 0.821 | 0.839 |
| Wald -Stat. | 1.83e+08*** | 17073.38*** | 5775.71*** |
| | (0.000) | (0.000) | (0.000) |
| Hausman Stat. | 26.51*** | 26.44*** | 61.35*** |
| | (0.002) | (0.002) | (0.000) |

*Note:* ***, **,* denote significance at 1%, 5% and 10% levels respectively while probabilities are in parenthesis.

*Source:* Computed by Author, 2020.

## 4.3 Discussion of results

Going by the results of the Hausman Chi-square test, which showed preference for the FE specification, the discussions in this section are based strictly on the results of FE estimations, which are contained in table 6. The study employed three measures of human capital which are: life expectancy (human capital in the area of health), primary school completion rate and secondary school enrolment rate, which are both human capital in the area of education.

From table 6, the population age group 0–14 years depressed life expectancy and secondary school enrolment significantly. About 44.57% of the population of West Africa is made up of this age group (see table 2). The implication is that a substantial proportion of the income of the working population, which is around 52.51%, is spent to cater for this age group, including their education. As the number of this age group (0–14) increases, it puts a strain on the income of the working population, and this affects other commitments, such as nutrition and healthcare services, which in most West African countries are financed out of pocket, and so on. The effect of this is evident in the declining enrolment in secondary school as well as school drop-out. The high rate of adolescent fertility contributes to the large number of this population with many of them out of school.

In West Africa, adolescent fertility averaged 131.55 births per 1,000 women aged 15–19 (see table 2). This constitutes a great burden on human capital as is evident in the negative and significant coefficients on life expectancy and secondary school enrolment rate (table 6). This is capable of impeding development in the sub-region. Moreover, high adolescent fertility of this magnitude could increase the rate of school dropouts, contribute to loss of productivity, and cause inter-generational transmission of poverty (McQueston, Silverman & Glassman, 2012). In developing regions like West Africa, a majority of adolescent mothers and their partners are from poor households and therefore struggle to make ends meet. Most of them are unemployed or at best engaged in menial jobs and earn low incomes. Their living condition is poor and they find it difficult to send their children to school while a high rate of child mortality is common among them. Thus, high adolescent fertility has the tendency to raise the risk of infant, childhood and maternal mortalities in the sub-region. A study conducted by Urdinola and Ospino (2015, 1487) in Colombia reported that most adolescent mothers with their partners "hold lower-class jobs, suffer higher rates of domestic violence at the hands of their partners, and have a higher share of deceased children." It will be difficult to cater for a large number of children in a sub-region with average per capita income of US$1,752: 67 (see Table 2). So, as adolescent fertility increases, human capital development will be negatively affected. Moreover, high fertility, particularly among adolescents, has the tendency to depress the budgets of poor families, and reduce their incomes, and the resources required to "feed, educate, and provide health care" (Birdsall and Griffin, 1998, 29).

Regarding how demographic variables influence human capital in the area of education, death and total fertility rates have negative and significant impact on primary school completion in West Africa while birth rate raises primary school completion rate. With respect to secondary school enrolment, population aged 0–14 together with those aged 65 and above and adolescent fertility depress secondary school enrolment significantly in the sub-region.

Demographic changes are critical for both human capital and sustainability of development. A high number of the population aged 0–14 implies high rate of child dependency ratio, and since the coefficients were negative and significant for most of the results, it implies that this population exert negative effect on human capital measures in the area of health and education. This is not healthy because it will starve the affected countries of funds required for savings, since a greater proportion of the income generated by the working age group will be expended on consumption and schooling to cater for themselves and this population group. The age group will provide opportunity for greater economic performance in the sub-region if the right and adequate investment is put in them. However, countries in the sub-region are not investing in this age group. The only way their potentials can be developed and tapped into to enhance human capital and sustainable development is to invest in training them.

Furthermore, it is observed that death rate poses a danger to human capital development in the sub-region as shown by negative coefficients and their significance across all the specifications. For instance, the population of the age group 65 and above in this sub-region is low, implying that people die earlier, which could cut short the level of productivity in such an economy because of the early demise of skilled persons.

With respect to other non-demographic variables in the study, per capita GDP had positive impact on human capital across the three human capital variables employed, with the influence on life expectancy and primary school completion rate being statistically significant. This shows that per capita income is an important determinant of human capital development in West Africa. This has also been the experience in advanced economies. Whether in the area of health, nutrition, education, and so on, income is key. At household level, a high income will provide access to better healthcare services, education, training, quality nutrition, and raise the level of household consumption. At the national level, a high per capita income scenario will enhance investment in health and education infrastructure and facilities, the provision of better healthcare services, boost the level of living and enhance economic development.

## 5. Summary, Conclusion and Policy Recommendation

The study analysed population dynamics and examined how it affects human capital development in West Africa over the period 1990–2017, covering 15 countries, using the static panel data econometric modeling approach, with the FE and RE estimating techniques. However, the Hausman test results supported FE. Three human capital measures were employed — average life expectancy at birth, primary school completion rate, and secondary school enrolment rate. The conclusion that emerged from the outcome of all the analyses performed in the study revealed substantially that population dynamics is a drag on human capital development in the West African sub-region. This is apparent in the negative sign reported for most of the coefficients of the demographic variables.

In view of this, policy enactment and implementation should focus on measures to control the high rate of fertility (particularly among adolescents), population growth rate (especially ages 0–14); and death rate in West Africa.

Specifically, education is an important policy required to control adolescent fertility and high growth rate of population aged 0–14. It is essential to provide access to quality education and improve girl child education in the sub-region. Education will prevent/reduce early marriage and teenage pregnancies, the risks of children and maternal mortalities, and further contribute to improvement in the health status of mothers and children as well as the rate of their survival. Moreover, education can enhance contraceptive usage, empower women to control birth, bargain for few children, participate in the labour market, thereby preventing early marriage and delay in child birth. Education will also provide the necessary skills and empower this young population before they transit to the working population. Therefore, beyond current efforts, rigorous investment in education facilities should be undertaken. Measures to achieve drastic reduction in death rate across the sub-region of West Africa should be put in place. This should involve investment in health facilities and infrastructure, and the provision of free or affordable medical care for children and women.

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