Sectoral growth in Africa: the role of the demographic dividend

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Abstract

This study examines the role of the demographic dividend on sectoral growth in Africa. The nexus between demographic dividend and economic growth has not been exhaustively assessed in the extant literature. The objective of this study is therefore to examine the links between the demographic dividend and sectoral growth in Africa, using the econometric methods of ordinary least squares, fixed and random effects, two-stage least squares and the method of moments. generalized on a panel of 44 African countries for the period 1991-2021. The findings indicate that the demographic dividend stimulates the growth of the primary sector to the detriment of the secondary and tertiary sectors. The implications of this study for economic policy suggest that realizing the opportunities that the demographic dividend confers would be a better asset for African economies aiming to develop the industrial sector. Furthermore, the findings lay the foundation for policymakers to formulate more effective policies to achieve the Sustainable Development Goals (SDGs).

Keywords: Sectoral economic growth; Demographic dividend; OLS; Random effect; Fixed effect; SDGs; GMM
JEL Classification: J00 ; J10 ; J18 ; O10 ; O55

1. Introduction

The global economy is slowing down. According to World Bank (2023) data, in 2019, the global economy recorded a low economic growth rate of 1.52%, which was projected to turn negative with the advent of COVID-19 and record a negative economic growth rate of -4.04% in 2020. In 2021, the world economy was experiencing a recovery with annual economic growth of 5.12% and a recorded slowdown of 2.26% in 2022. This slowdown can be justified by the increase in trade barriers, increased trade and geopolitical uncertainties, specific factors causing macroeconomic tensions in several emerging countries and structural factors in advanced countries, such as low productivity and aging populations (IMF, 2019).

Can sectoral growth say the same? First in 2019, the primary sector represented a contribution of 2.89%, then a recorded decline of 2.67% in 2020, then a recorded slowdown of 2.15% in 2021 and finally a recorded recovery of 2. 67% in 2022 (WDI, 2023). At least 63% of the world's poorest people survive through agriculture and almost 80% of them live in rural areas. Although it is estimated that around 200 million rural poor will move to urban areas over the next 15 years, population growth projections show that the absolute number of poor people living in rural areas will hardly change. As countries step up efforts to improve agricultural productivity, agribusiness offers more and more employment opportunities and it is increasingly important that developing countries seize these opportunities (World Bank, 2022).

Then, regarding the secondary sector, it represented a global contribution of 0.74% in 2019, then a recorded recession of -4.22% in 2020, then a recorded recovery of 7.80% in 2021 and

finally an observed slowdown of 1.79% in 2022 (WDI, 2023). Over the past 65 years, of the 13 countries that have shown positive growth for at least 25 years, 10 of them owe it mainly to the manufacturing industry. Global demand for manufactured goods is expected to grow over the next decade, particularly in developing countries. This trend opens up prospects for these countries whose manufacturing industry will be able to develop, open up to international markets while meeting domestic demand (World Bank, 2022).

Finally, regarding the tertiary sector, the latter brings a volume of 2.96% in 2019, then a recession of -3.35% in 2020, then a recorded recovery of 6.12% in 2021 and finally showed a slowdown with a volume of 1.39% in 2022 (WDI, 2023). Services today constitute a diversified and complex economic sector. With one out of eleven jobs in the world, it is among the most prosperous sectors. In developing countries, one of the main determinants of economic growth has been tourism. The number of employment opportunities brought about by the tourism industry can be quite relevant, especially because this sector is characterized by substantial needs in labor and employs a substantial number of women and young people (World Bank, 2022).

Despite the fact that other regions are endowed with significant natural resources, we realize that sectoral growth is slow to start due to the weakness of transformations, poor governance and especially demographic growth, with regard to African countries. Africa experienced fairly strong economic growth in the early 2000s. However, these economies are following different trajectories. For example, the continent's economic growth in 2018 was 1.24%, close to that recorded in 2017. Overall, 18 African countries recorded growth rates above 5% in 2018, while 17 countries experienced growth rates of between 3% and 5%, and only five African countries experienced a recession compared to nineteen in 2018 (WDI, 2023). The African economy recorded a low economic growth rate of 3.13% in 2019, became negative by registering -2.60% in 2020, then recorded a recovery of 4.72% in 2021, and finally recorded a slowdown of 4 .21% in 2022 (WDI, 2023). Despite its constant growth rate for almost two decades, the continent continues to lag behind in terms of economic development.

Observing sectoral growth in Africa, Firstly, the primary sector reveals an annual production of 3.17% in 2019, then drops to 2.28% in 2020, before increasing to 3.95% in 2021, and finally exhibits a slowdown of 1.57% in 2022. Secondly, regarding the secondary sector, 2019 recorded a low contribution of 1.74%, before it became negative be -3.08% in 2020, then registered a recovery of 4.10 % in 2021, and finally a slowdown of 3.64% in 2022. And thirdly, regarding the services sector, Africa recorded a volume of 3.38% in 2019, then a negative contribution of -3.39 % in 2020, then a recovery with a volume of 4.68% in 2021, and finally showed an increase in volume of 5.02% in 2022 (WDI, 2023).

The scientific world today agrees that global, continental and regional populations are increasing more rapidly than 30 or 50 years ago (Sekher and Govil, 2022). Due to the declining birth rate, the population is continuously growing, but at a rate that is slower compared to any time prior to 1950. The world's population was estimated at 8 billion in 2022, with a projected increase to 9.7 billion in 2050 from 8 .5 billion in 2030, and subsequently 10.4 billion in 2100 (United Nations, 2022). The analysis of the relationships between demography and

development has long been limited to examining the impact of demographic growth on economic growth and development dynamics (Rabier, 2020). However, for two decades it has focused on the evolution of the population's age structure, taking into account the progression of the demographic transition process in developing countries, which temporarily increases the share of the potentially active population relative to the total population. Africa, the second most populous continent in the world (behind Asia), has a young and economically active population (Moussavou, 2017). This situation is seen as opening a window of opportunity to accelerate the growth trajectory of the countries concerned, a situation described as a "demographic dividend". The demographic dividend is not a new concept, it dates back to the work of Malthus (1798) "The book An Essay on the Principle of Population" was first published anonymously in 1798, but the author was soon identified as Thomas Robert Malthus, who had already posed the problem between population growth and resource growth with both arithmetic and geometric progressions. This concern remains perceptible throughout the world and particularly in Africa, which stands out in the current context as the second most populous continent behind the Asian continent (UNFPA, 2019).

According to Bloom and Williamson (1998), the demographic dividend describes the interaction between changes in the age structure of the population and economic growth. Indeed, a fall in infant mortality, followed by a fall in fertility, results in a reduction in the dependency ratio and a period during which a country has a high proportion of people of working age. This seems to be the consensual definition, according to the United Nations (2013), the demographic dividend refers to the positive effect of changes in the age structure of the population on economic growth - in other words, the acceleration of economic growth that can result from a change in the age structure of the population accompanied by strategic investment in health, economic policy and governance. However, there is no consensus on the appropriate method for estimating the demographic dividend, since it can be approached from either a macro- or micro-economic perspective. Differences in perspective relate not only to the specific indicator to be adopted, but also to the appropriate period to be taken into account to quantify the demographic dividend (Delaunay and Guengant, 2019; King et al., 2021). In light of the above, our study has adapted an indicator that captures the demographic dividend, while taking into account the unique circumstances of African nations. The summary of indicators for measuring the demographic dividend is presented in the appendix.

The demographic dividend in Africa can contribute to sectoral growth, particularly through its impact on education and human capital development (Cilliers, 2018). Osei-Appaw and Christian (2022) showed a negative correlation between education and fertility rates in sub-Saharan Africa, indicating that investments in education can lead to reduced fertility rates and contribute to the demographic dividend. Hosan et al. (2022), support that demographic dividend stimulates sustainable economic growth. To this end, African countries can further increase their demographic dividends, leading to economic growth and poverty reduction (Ahmed et al., 2014).

The intercontinental inequalities generated by this threat result in significant migratory flows, insecurity linked to the exhaustion of natural resources and environmental risks associated with

waste management (or climate change). Developing nations, particularly those in Africa, are not spared. The ability of States to correctly allocate resources to meet the needs of the population is hampered by this demographic shock. From a theoretical standpoint, the effect of population growth has been addressed in the literature through the theory of demographic transition (Cowgill, 1963), which is for many the population theory by excellence. Empirically, there remains a lack of consensus regarding the incidence of population growth and/or the demographic dividend on sectoral growth. Specifically, the demographic dividend may enhance, reduce, or have no effect on sectoral economic growth.

Many previous studies have shown that economic growth is affected by trade openness (Amna Intisar et al., 2020), natural resource rent (Ampofo et al, 2020), FDI (Ongo Nkoa, 2014; Sahu , 2021), financial development (De Gregorio and Guidotti, 1995; Joseph, 2019; Yang, 2019), final consumption expenditure of public administrations (Bloom and Williamson, 1998), inflation (Barro, 1995; He and al., 2022), the informal sector (Medina and Schneider, 2018) and many other economic, social and political factors. In essence, a multiple regression approach was used to establish a linear nexus between sectoral economic growth and the demographic dividend.

The present study contributes to the extant literature in a multitude of ways. First, this study proposes taking into account unemployment, the informal sector and African solidarity in measuring the demographic dividend. Second, we propose for the first time a study on the link between the demographic dividend and sectoral growth in Africa. The work of Mulugeta Woldegiorgis (2023) highlights the pressing need for African economies to develop through demographic growth in order to significantly reduce poverty and stimulate economic growth. Therefore, our study fills the gap in knowledge gap on the considerable and persistent variations in the global pattern of inclusive growth, highlighting the effect of the role that the demographic dividend can play. Third, this document adopts a solid methodological approach through the use of the system generalized method of moments (GMM) and double least squares with instrumental variables to deal with the endogeneity problem. Fourth, the results of this research, which precisely highlight the thresholds at each stage of the empirical analysis, will provide suggest recommendations to motivate the governments of African countries to promote growth. This work advocates for a positive correlation between demographic dividend and sectoral growth, for the achievement of the sustainable development goals (SDGs). Finally, this work can serve as a basis for future research on the subject.

This document is structured into six sections. The second section covers the literature review, the methodology is presented in the third section, the fourth section sets out the stylized facts, the fifth section reveals the empirical results, and finally the sixth section concludes by formulating some recommendations for economic policies.

2. Literature review

In this section, two main points attract our attention. Namely, firstly, a development of a theoretical synthesis, and secondly a brief empirical review.

2.1. Theoretical syntheses

Although the study of demography did not emerge as a field of study until the 20th century, economists had ample time to consider the question of population before that time. However, this particular topic has not always been at the center of their concerns. It was certainly important to the early economists, the mercantilists, and later to classical economics, which emphasized the need for a large population. However, with the publication of Malthus's Essay on the Principle of Population (1798), a broad consensus emerged against excessive population growth. Many consider the theory of demographic transition, on which the concept of demographic dividend is based, to be a complete theory of population (Cowgill, 1963; Sandron, 2002).

2.1.1. Traditional explanation

In the current academic debate, a central question that concerns both economists and academics is the degree by which the demographic dividend contributes to the economic growth process. However, many studies also assert that demographics or population growth are among the most essential factors that catalyze the distribution of economic activity (Sauvy, 1986).

According to the first group of so-called pessimistic theorists, the argument is that the population's multiplying power is infinitely higher compared to the earth's power to produce food for man, as shown by the arithmetic progression of food resources and the geometric progression of the human race (Malthus, 1798; Ehrlich, 1968). Thus, the existence of regulatory mechanisms, of repressive brakes which create wars, famines and other epidemics which inevitably occur in the case of an overabundant population, prevent the population from growing at this biological rate over time (Meadows et al., 1972). The Malthusian trap, according to these models, would maintain the population at subsistence level, any economic surplus being absorbed by population growth (Cole and Dubsky, 1974).

According to the second stream of so-called optimistic theorists, Lewis (1954), develops a model that explains how countries can achieve sustained economic growth by transforming the workforce from low-productivity agricultural sectors to high-productivity industrial sectors. This model provides valuable insights for understanding sectoral growth and its implications for economic development. Boserup (1965, 1981) in turn argues that the juxtaposition of an arithmetic growth of resources and a geometric expansion of the population is not justified because the first is determined by the second. The capacity for innovation, and therefore, the propensity to produce more, is directly proportional to the size of the population (Kuznets, 1967). Other researchers bring the concept of "optimal population" to the interface of the two currents: "population too numerous for some and not enough for others", in the search for general well-being (Robbins, 1927; Landry, 1982). The theory of the population optimum has above all provided a scientific veneer to discussions on population, but the determination of this optimum poses a problem. As Buquet (1956) shows, the problem of the general population optimum goes beyond the limits of the economic population optimum, and we must instead consider the demo-economic state of a nation, including all the relationships in where the population and the economy are located. Thus, the optimal population is "the one which ensures in the most satisfactory manner the achievement of a given objective" with reasoning based on the notion of increasing then decreasing returns (Houdaille, 1973; Céron, 1974).

In light of all of the above, Teitelbaum (1975) argues that the theory of demographic transition is essentially a plausible description of a complex social and economic process that occurred in Europe throughout the 19th century (Thompson, 1929, 1934; Landry, 1934, 1948; Notestein, 1945, 1950; Coale and Hoover, 1958).

2.1.2. Modern explanation

The link between population expansion and economic expansion has undoubtedly been the subject of debate since the time of Malthus (1798). Since the 1990s, the modern so-called "neutralist" thesis has emerged from this debate. Several researchers provide their explanations on the relationship between demographic growth and economic growth.

According to Bloom and Williamson (1998), population growth may or may not influence economic prosperity. More attention should be paid to the age structure of the population induced by the demographic transition, following the example of the economic boom of the dragons and tigers of East Asia, by using for the first time the concept "demographic dividend". Along the same lines, Williamson (2013) explains that the demographic dividend is not simply an effect of the labor market participation rate, but also an effect of growth. Lifelong savings, deepening investment, foreign capital flows and schooling, *inter alia*, have been substantially affected by the demographic transition. The study of changing age structure gained relevance in the late 1980s and 1990s as research revealed that the demographic dividend resulting from the demographic transition had major consequences for economic growth (Bloom et al., 2003; Olabiyi, 2018; Sanchez-Romero et al., 2018).

Two new elements of the theoretical literature on quantifying the effects of the demographic bonus on economic growth have recently appeared (Young et al., 2019). The first path considers fertility as an independent variable that affects the working age proportion of the population, leading to higher productivity and economic growth. The second, linked to education, is productive human capital which reduces fertility and increases productivity. Although both fertility and human capital are essential to economic growth, the unified growth theory has identified the human capital factor as a key driver of both demographic change and economic growth (Renteria et al., 2016; Lutz et al., 2019).

This article, however, distinguishes itself from pessimistic, optimistic or neutralist theories by arguing that it is very important to understand the age distribution and dynamics, given that individuals in all age groups do not have the same levels of productivity (Mason et al., 2017). In East Asian countries, changing age distributions, combined with inclusive public policies, have played a crucial role in their "economic miracle", given that the working-age population has increased significantly, faster compared to the dependent population during the period 1965 and 1990 (Bloom et al., 2003; Mason et al., 2017; Mulugeta Woldegiorgis, 2023).

2.2. Empirical syntheses

Various explanations for the incidences of the demographic dividend have been proposed in the literature from different perspectives (Han, 2019). First, a group explaining the positive effects

of the demographic dividend on economic growth. In their study on nexuses between human capital, economic growth and age structure with the remit of a disaggregated analysis over a period from 1960 to 2014 covering developing countries, and having used the method of generalized moments by difference, Ahmad and khan (2018) find that age structure and human capital positively influence economic growth in the economies under study at all disaggregated levels. According to Sanchez-Romero et al. (2018) in their study on demography's contribution to economic growth, by implementing an overlapping generation model, find that from 1850 to 2000, approximately 17% of the improvement in GDP per capita in Western European countries, is due to the demographic transition, which is explained by the fact that about 50% of the demographic contribution comes from the average productivity per worker arising from the change in the age structure of the population. Jafrin et al. (2021) using the clustered least squares method on data from the countries of the South Asian Association for Regional Cooperation for a period from 1990 to 2017, study the relationship between the demographic dividend and economic growth. The results show that the demographic dividend positively affect economic growth in this region under study.

Then, on the other hand, a group of explanations on the negative effects of the demographic dividend on economic growth. In a study on "demographic change and economic growth" applied to a panel of organization for economic corporation and development (OECD) countries, period from 1950 to 2011, using an overlapping generations model, Gestsson and Zoega (2016), find proof that the Low population growth slows down productivity and therefore economic growth in the economies under study. Sadeghi (2018) in a study on the relevance of the balance between demographic change and economic growth in terms of achieving economic growth that is sustainable within the remit of upper middle-income countries, period from 985 to 2016, using the method of fixed effects and random effects, finds that during the period under study, the closer we get to the time, the more the impact of demographic growth in upper middle income countries decreases, by proposing the control of the increase in population for the benefit of the productive age group. According to Zaman and Sarker (2021) in a study on the link between demographic dividend, digital innovation and economic growth applied in Bangladesh for a period from 1990 to 2019, using the three-stage least squares method (3SLS), find that economic growth is negatively influenced by the demographic dividend.

Ultimately, within another strand of clarification on the varying impacts of demographic dividend on economic prosperity, Pasichnyi and Nepytaliuk (2021) analyse how demographic factors influence economic growth from 1990 to 2018 in a sample of 45 emerging countries. The authors use an unbalanced panel dataset with the OLS approach to establish that for the sampled periodicity, the considered demographic indicator is substantially connected to nominal gross domestic product (GDP) per capita. Moreover, the demographic indicator examined in advanced economies was substantially higher compared to emerging countries. It was also established that improvements in population of working age considerably reduced dynamics of GDP, though corresponding interconnectedness failed to be robust. Over the long run, it is worthwhile to take the institutional framework into consideration in view of realizing public performance that is favorable. Moreover, endogenous economic triggers oriented the prediction and calibration of demographic variables. Hosan et al. (2022) in their empirical study

on nexuses among digitalization, demographic dividend, sustainable economic growth and energy intensity, employing distributed autoregressive lag augmented on cross-sectional data (CS-ARDL), establish that in the long run sustainable economic growth is positively driven by digitalization and demographic dividend, which is not necessarily the case for short-term results. Mulugeta Woldegiorgis (2023), in a study on inclusive development by means of exploiting the demographic dividend in Africa, using ordinary least squares regression, finds the exploitation of demographic dividend entails substantial investment in industrialization, digitalization, family planning, and creation in view of the results obtained after analysis. Moreover, the contribution of young people from 1990 to 1999 and from 2000 to 2018 was remarkably positive.

Overall, these studies highlight the complex relationship between the demographic dividend and economic growth. The literature suggests the need for comprehensive strategies and investments to harness the potential of the demographic dividend in Africa. However, it would be counterproductive to neglect the effects of the demographic dividend in contributing to sectoral economic growth (Velnampy and Achchuthan, 2014). To our knowledge, few studies have addressed this question in the existing literature, which is why this study takes the privilege of investigating the role that the demographic dividend plays with regard to the primary, secondary and tertiary sectors in order to achieve inclusive growth in Africa.

3. Methodologies

Two main points attract our attention in this section. Firstly, a development from a theoretical model to an empirical model, and secondly a brief presentation of the data and the estimation technique.

3.1. From theoretical model to empirical model.

The nexus between economic growth at the sectoral economic level and the demographic dividend can be examined by employing endogenous growth models, primarily owing to endogenous growth theories which show that investment in knowledge, innovation and human capital has positive externalities and impacts on the economy to stimulate economic development (Romer, 1990). However, demographic variations influence fundamental intermediate outcomes of economic development, such as human capital, investment, savings and per capita economic growth (Mason et al., 2016; Amer Ahmed et al., 2016). Furthermore, the theoretical structure that motivates the empirical analysis of the economic impacts of demographic changes is relatively evident in the existing literature. To be more precise, for example, it is common to use the models of Baerlocher et al. (2019) and Hall and Jones (1999) in deriving an estimation equation that clarifies the growth rate of GDP per capita of a region while taking into account economic and demographic factors. Based on a simplified Cobb-Douglas production function, production is defined as follows:

$$Y_{it} = A_{it} L_{it}^{\alpha} K_{it}^{1-\alpha} \quad (1)$$

Where K, L and Y, respectively represent labor, physical capital and output of an economy. A shows total factor productivity, whereas α and $(1 - \alpha)$ denote, respectively the labor and

physical capital production elasticities. Here,i shows the country and the time. Equation (1) can be written again as follows:

$$Y_{it} = A_{it}\left(\frac{K_{it}}{L_{it}}\right)^{1-\alpha} L_{it} \quad (2)$$

Output per capita can then be broken-down into three factors, as shown in equation (3):

$$\frac{Y_{it}}{P_{it}} = A_{it}\left(\frac{K_{it}}{L_{it}}\right)^{1-\alpha} \frac{L_{it}}{P_{it}} \quad (3)$$

Today, with the improvement of the demographic dividend, the L/P factor increases. When the ceteris paribus condition is recognized, this per capita income, or the Y/P of the economy, would increase**.** It could appear that in the demographic dividend phase, the increase in labor results in a decrease in capital per unit of labor (i.e. K/L). However, the increase in per capita income would have a favorable knock-on effect on investments and savings, leading to greater economic accumulation of capital. Ultimately, a trend may emerge that K/L would not decrease owing to the nature of the economy's demographic dividends; Furthermore, it would also create an opportunity for more human capital investment, which would increase future dividends through a more skilled workforce. Labor forces, Lit in equation (4), can be transformed into labor forces. Therefore, equation (3) can be rewritten as follows:

$$\frac{Y_{it}}{P_{it}} = A_{it}\left(\frac{K_{it}}{L_{it}}\right)^{1-\alpha} \frac{(Pop\ 0to14yrs + Pop\ 65yrsabove)}{(Pop\ 15to64yrs)\ x\ (1-k)} \quad (4)$$

Furthermore, when a demographic transition is advantageous, many people enter the labor market and, therefore, to survive in a competitive environment characterized by scarce financial and capital endowments, the importance of capital, labor and total factor productivity remains fundamental. These could boost the technological frontier (represented by total factor productivity) upwards. Therefore, a demographic dividend scenario would result in improvements in three main factors, which ultimately lead to improvements in economic output per capita, namely: total factor productivity (A), active labor force (L/P) and physical capital per unit (K/L) (Baerlocher et al., 2019; Zaman and Sarker, 2021). It follows that the aggregate production function illustrates the components that determine the economic prosperity of a nation, such as physical capital, human capital and divided demographics (Omri et al., 2015; Ha and Lee, 2016; Chen et al., 2018; Baz et al., 2019; Panet et al., 2019; Saud et al., 2019; Ahmad et al., 2020; Ahmed et al., 2020; Ren et al., 2021; Nguyen and Su, 2021).

In line with the objective of this research, which is to assess the link between economic growth and the demographic dividend, the choice of empirical strategy is motivated by previous studies that have largely focused on similar problem statements (Bloom and Williamson, 1998; Bloom et al., 2000; Bloom and Finlay, 2009; Misra, 2015). Therefore, the present research uses panel data analysis, particularly because it allows the study to explore both time series and cross-sectional properties of the data. Panel data has the advantage of reducing the risk of obtaining biased results, providing a substantial number of observations to increase degrees of freedom, helping to avoid spurious regressions, and the regression result is more authentic (Kao, 1999;

Philips and Moon, 2000; Baltagi, 2005; Hsiao, 2005; Misra, 2015). Our sample is made up of 44 African countries over a period from 1991 to 2021.

With the exception of data on human capital and economic growth in terms of output, which come from the Penn World Table 10.0 database (Feenstra et al., 2015), the data come mainly from: (i) the World Development Indicators of the World Bank (WDI, 2020) for macroeconomic variables, (ii) the global governance indicators (Kaufmann, 2007; WGI, 2020) for governance variables and (iii) the United Nations Conference on Trade and Development (UNCTAD, 2020) for inflation. Data availability justifies the choice of this time horizon.

In the present study, we use a Cobb Douglas transformer growth model from Jafrin et al. (2021). Thus, we considered the effect of the demographic dividend on economic growth by employing a functional form that illustrates economic growth as a function of the demographic dividend inspired by the work of Jafrin et al. (2021) as apparent in equation (5):

$$Economic\ growth\ =\ f(Demographic\ dividend) \qquad (5)$$

The authors extend the model of equation (1) by considering other variables that can have an impact on economic growth (GDP in terms of production). In essence, a multiple regression approach was used to determine a linear nexus between economic growth and the demographic dividend. The corresponding equation (6) is:

$$GDP_{it} = \alpha + \beta_1 DD_{it} + \beta_2 LFPR_{it} + \beta_3 GCFG_{it} + \beta_4 UR_{it} + \beta_5 TO_{it} + \varepsilon_{it}\ , \qquad (6)$$

where i denotes the individual country, while t represents time. The annual economic growth rate was used as an indicator of economic development (dependent variable), and subsequently represented by the GDP_{it}. For the main independent variable, namely the demographic dividend (hereinafter referred to as DD_{it}), $LFPR$: the labor force participation rate, UR : unemployment rate, $GCFG$: the annual growth of gross capital formation, TO : trade openness. $\alpha, \beta 1, \beta 2, \beta 3, \beta 4, \beta 5$ represent the parameters of interest and ε_{it} the error term.

We take this equation from Jafrin et al. (2021) by integrating our analysis variables. Thus, we will rewrite this equation in the simplest way possible because the subscript i will indicate the individual country and t the period of application. Also, we replace the dependent variable with the growth rate of the production outlook (GDP). Furthermore, since we are analyzing the effects of the demographic dividend on sectoral economic growth, the dependent variable will be captured, respectively, by the value added of agriculture, forestry and fishing as % of GDP for the primary sector, manufacturing value added as a % of GDP for the secondary sector, and services value added as a % of GDP for the tertiary sector, as informed by equation (7):

$$\begin{aligned} lnGDPO_{it} = {} & \alpha + \beta_1 DivdemWPP_{it} + \beta_2 Caphumain_{it} + \beta_3 Ouvercom_{it} + \\ & \beta_4 Rentesressnatur_{it} + \beta_5 FDI_{it} + \beta_6 FinDev_{it} + \beta_7 Gengovfinconsump_{it} + \\ & \beta_8 lnInflation_{it} + \beta_9 Informalsector_{it} + \beta_{10} Gouvernance_{it} + \varepsilon_{it} \end{aligned} \qquad (7)$$

Where $lnGDPO_{it}$ represents GDP per capita in terms of production as the dependent variable. For the main independent variable, namely the demographic dividend calculated according to the WPP (2019) formula – here in after denoted by $DivdemWPP_{it}$, $Caphumain_{it}$: human capital, $Ouvercom_{it}$: trade openness, $Rentesressnatur_{it}$: total rent from natural resources, FDI_{it} : foreign direct investment, $FinDev_{it}$: financial development, $Gengovfinconsump_{it}$: government final consumption expenditure (% of GDP), $lnInflation_{it}$: inflation measured by the consumer price index, $Informalsector_{it}$: the size of the informal sector in the economy and $Gouvernance_{it}$: the quality of institutions. $i\,(1\ldots\ldots,N), t\,(1\ldots\ldots,T)$ represents individual countries and time (year), respectively, α indicates the constant and the β_n denotes the parameters to be estimated.

Many previous studies have shown that economic growth is affected by trade openness (Amna Intisar et al., 2020), natural resource rent (Ampofo et al, 2020), FDI (Ongo Nkoa, 2014; Sahu , 2021), financial development (De Gregorio and Guidotti, 1995; Joseph, 2019; Yang, 2019), government final consumption expenditure (Bloom and Williamson, 1998), inflation (Barro, 1995; He and al., 2022), the informal sector (Medina and Schneider, 2018) and many other economic, social and political factors. In essence, a multiple regression approach was used to determine a linear relationship between sectoral economic growth and the demographic dividend.

3.2. Data and estimation technique

The definitions and sources of variables are disclosed in Table 1 while Table 2 presents the descriptive statistics which show the general characteristics of the variables used in the study. More precisely, the table indicates, among other things, the periodicity of the study, the number of observations as well as the range (i.e. the minimum and maximum values) for each variable. Additionally, standard deviations and mean values are also shown. For the countries in the sample, it appears that the average growth rate of GDP per capita in terms of production is 10.12%, with minimum and maximum values of 6.695% and 14.008%, respectively. It can also be observed that on average, the selected countries reflect considerable demographic dividend rates, ranging from 0.413% to 1.128%. Where as the outcome variable is lnGDPO, DivdemWPP is the main independent variable of interest which, are distributed within a narrow range. It is worthwhile to note that some indicators nonetheless reflect greater variability in the light of standard deviation values. Moreover, a wider gap between the other variables shows a significant difference in the macroeconomic features of nations.

Regardless of demographic dividends that appear similar, not all countries can accommodate the workforce. Furthermore, it is evident that there is a substantial standard deviation and a wide range (i.e., minimum to maximum) in financial development (FinDev), meaning that the countries selected substantially vary in terms of financial development. The correlation between the variables is then presented in Table 3.

Table 3 indicates that the DivdemWPP has a negative correlation with GDP per capita in terms of production. The independent variables present a rather contrasting association with the GDP-output approach, some are negatively correlated and while others are positively linked. Furthermore, we see evidence of multicollinearity between the selected independent variables.

The Variance Inflation Factor (VIF) values of all the independent variables are presented in the appendices.

Table 1: Definitions and sources of variables

Type	Indicators		Acronyms	Definitions	Expected signs	Sources
Dependent Variable	Economic growth	Output-side real Gross domestic product per capita	GDPO	Output-side real GDP at current PPPs (in mil. 2017US$)		Penn Table 10.00
	Primary sector	Agriculture, forestry, and fishing, value added (% of GDP)	Primary sector	Value added as a % of GDP, from forestry, hunting and fishing, as well as crops and livestock.		World Development Indicator
	Secondary sector	Manufacturing, value added (% of GDP)	Secondary sector	The value added of manufacturing industries as a % of GDP.		
	Tertiary sector	Services, value added (% of GDP)	Tertiary sector	This is the value added as a % of GDP in wholesale and retail trade (including hotels and restaurants), transport and public, financial, professional and personal services such as education, healthcare and real estate.		
Independent variable	Demographic dividend	According to Bloom and Williamson (1998), it's the description of the interaction between changes in the age structure of the population and economic growth.	DivdemWPP	Is the demographic dividend obtained using the World Population Prospect formula, i.e. ((Pop aged 0 to 14 + Pop aged 65 and over) / (Pop aged 15 to 64)).	(-) GDPO (+) Primary sector (-) Secondary sector (-) Tertiary sector	World Population Prospect 2022
			Divdem	Is the demographic dividend we propose, i.e. ((Pop aged 0 to 14 + Pop aged 65 and over) / (Pop aged 15 to 64)*(1-k)), with k as the unemployment rate.	(-) GDPO (+) Primary sector (-) Secondary sector (-) Tertiary sector	Auteurs from King and al. (2021)
Control variables	Human Capital	hc	Humcap	Human capital index, based on years of schooling and returns to education.	(+) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	Penn Table 10.00
	Trade	Trade (% of GDP)	Trade Openness	Is the sum of exports and imports of goods and services measured as a share of gross domestic product.	(-) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	World Development Indicator
	Total natural resources rents	Total natural resources rents (% of GDP)	Natresrents	Is the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	(+) GDPO (+) Primary sector (-) Secondary sector (-) Tertiary sector	
	Foreign direct investment, net inflows	Foreign direct investment, net inflows (% of GDP)	FDI	Refers to the total value of direct investment by foreign entities into a country's economy, minus the total value of direct investment by domestic entities into foreign economies. It represents the net flow of investment capital from foreign sources into a country over a specific period.	(-) GDPO (+) Primary sector (-) Secondary sector (-) Tertiary sector	
	Financial development	Domestic credit to private sector (% of GDP)	Findev	Refers to the process and degree of improvement in financial systems within an economy (Levine, 1997).	(+) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	
	Government final consumption expenditure	General government final consumption expenditure (% of GDP)	GFCE	Refers to the total value of goods and services consumed by the government in an economy.	(-) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	
	Government Effectiveness		GE	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	(+) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	

	Control of Corruption		CC	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	(+) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	Worldwide Governance Indicators
	Political Stability and Absence of Violence/Terrorism		PL	Is the perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.	(-) GDPO (-) Primary sector (-) Secondary sector (+) Tertiary sector	
	Regulatory Quality		RQ	Is the perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	(+) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	
	Rule of Law		RL	Is the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	(+) GDPO (-) Primary sector (+) Secondary sector (+) Tertiary sector	
	Voice and Accountability		VA	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	(+) GDPO (-) Primary sector (-) Secondary sector (+) Tertiary sector	
	Log. Inflation	Inflation, consumer prices (annual %)	Inflation	Refers to the sustained increase in the general level of prices for goods and services in an economy over a period of time.	(+) GDPO (+) Primary sector (-) Secondary sector (-) Tertiary sector	UNCTADstat
	Size and development of the shadow economy		Informal sector	Refers to the extent and growth of economic activities that are not reported or regulated by the government and thus operate outside the formal economy. This includes informal economic activities, undeclared work, and unreported income that may be hidden from official statistics and tax authorities.	(-) GDPO (+) Primary sector (-) Secondary sector (-) Tertiary sector	Medina and Schneider (2019).

Source: Authors

Table 2. Summary statistics

	Observations	Mean	S.D	Minimum	Maximum
lnGDPO	1276	10.12	1.456	6.695	14.008
Primary sector	1242	10.12	0.783	0.587	4.156
Secondary sector	1159	2.869	0.592	-1.458	3.910
Tertiary sector	1227	2.305	0.245	2.387	4.344
DivdemWPP	1276	0.85	0.152	0.413	1.128
Divdem	1276	0.781	0.176	0.363	1.113
Humcap	1131	1.728	0.428	1.034	2.939
Trade Openness	1195	4.063	0.503	0.198	5.169
Natresrents	1276	1.762	1.519	-6.75	4.072
GE	1056	-0.662	0.597	-1.884	1.057
CC	1056	-0.597	0.588	-1.723	1.217
PL	1056	-0.555	0.885	-2.845	1.219
RQ	1056	-0.593	0.567	-2.298	1.127
RL	1056	-0.632	0.631	-2.13	1.077
VA	1056	-0.575	0.685	-1.859	1.007
FDI	1273	2.877	4.643	-11.199	46.275
Findev	1134	20.242	23.358	0	142.422
GFCE	1125	14.353	5.802	0.911	43.484
lnInflation	1276	43.593	690.071	-72.729	23773.13
Informal sector	1276	37.678	8.139	17.8	64

Notes: Humcap: Human capital. Natresrents: Natural resource rents. GE: Government effectiveness. CC: Corruption-control. PL: Political Stability. RQ: Regulatory Quality. RL: Rule of Law. VA: Voice & Accountability. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. S.D: Standard Deviation. DivdemWPP: is the demographic dividend obtained using the World Population Prospect formula; Divdem: is the demographic dividend improved by the authors, as an alternative measure.

Source: Authors

The model is estimated mainly by the ordinary least squares (OLS) method (Legendre, 1805; Gauss, 1809; Samueli, 2010) and fixed effects - random effects (Mundlak, 1961; Balestra & Nerlove, 1966). These estimation techniques, although old, present certain shortcomings, in particular the failure linked to heteroscedasticity. However, the literature proposes to resolve these issues by estimating the model with robust standard errors. Furthermore, panel OLS considers that the individuals in the sample are homogeneous, which is often not the case. In our case, although individuals all belong to the same economic order (developing countries) supporting the hypothesis of homogeneity, African economies present disparate and/or heterogeneous developments. This is why the use of fixed and random effects estimators is necessary to study individual effects in our sample.

Table 3. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) lnGDPO	1.000													
(2) Primary sector	-0.276	1.000												
(3) Secondary sector	0.314	-0.261	1.000											
(4) Tertiary sector	0.218	-0.402	0.269	1.000										
(5) DivdemWPP	-0.426	0.675	-0.334	-0.383	1.000									
(6) Humcap	0.437	-0.754	0.155	0.350	-0.714	1.000								
(7) Trade openness	-0.157	-0.539	0.069	0.128	-0.452	0.410	1.000							
(8) Natresrents	0.038	0.310	-0.158	-0.481	0.450	-0.270	-0.187	1.000						
(9) FDI	-0.069	0.024	-0.200	-0.075	0.071	-0.058	0.276	0.134	1.000					
(10) Findev	0.440	-0.550	0.253	0.496	-0.683	0.457	0.185	-0.478	-0.078	1.000				
(11) GFCE	-0.228	-0.263	0.164	0.194	-0.186	0.014	0.347	-0.091	0.013	0.202	1.000			
(12) lnInflation	0.091	0.097	-0.037	-0.080	0.014	0.047	-0.114	0.057	-0.011	-0.085	-0.201	1.000		
(13) Informalsector	-0.176	0.300	-0.125	-0.285	0.497	-0.300	-0.164	0.434	-0.038	-0.512	-0.204	0.073	1.000	
(14) Governance	0.096	-0.560	0.037	0.490	-0.530	0.456	0.393	-0.614	-0.026	0.554	0.260	-0.115	-0.428	1.000

Notes: Humcap: Human capital. Natresrents: Natural resource rents. GE: Government effectiveness. CC: Corruption-Control. PL: Political Stability. RQ: Regulatory Quality. RL: Rule of Law. VA: Voice & Accountability. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. DivdemWPP: is the demographic dividend obtained using the World Population Prospect formula.

Source: Authors

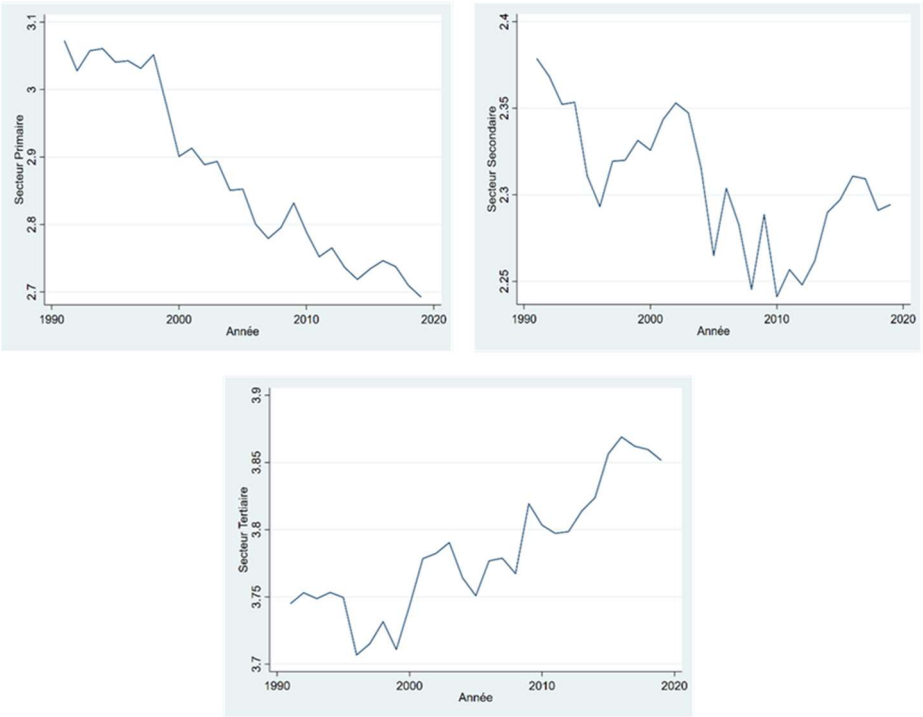
4. Some stylized facts

Three stylized facts attract our attention in observing the demographic dividend and sectoral growth in Africa.

4.1. Sectoral growth is improving in Africa

As shown in Figure 1, in its first part - 1st graph of the figure - the contribution of the primary sector in the African economy, represented a volume of 26.24% of GDP in value added in 1991, then recorded a regression to 22.47% of GDP in value added in 2005 and maintained this downward trend by recording a volume of 19.22% of GDP in value added in 2019 (WDI, 2022). This downward trend can be explained by political instabilities, migratory movements, climate change, *inter alia*.

Figure 1. Evolution of sectoral economic growth in Africa



Source: Authors from WDI (2022)

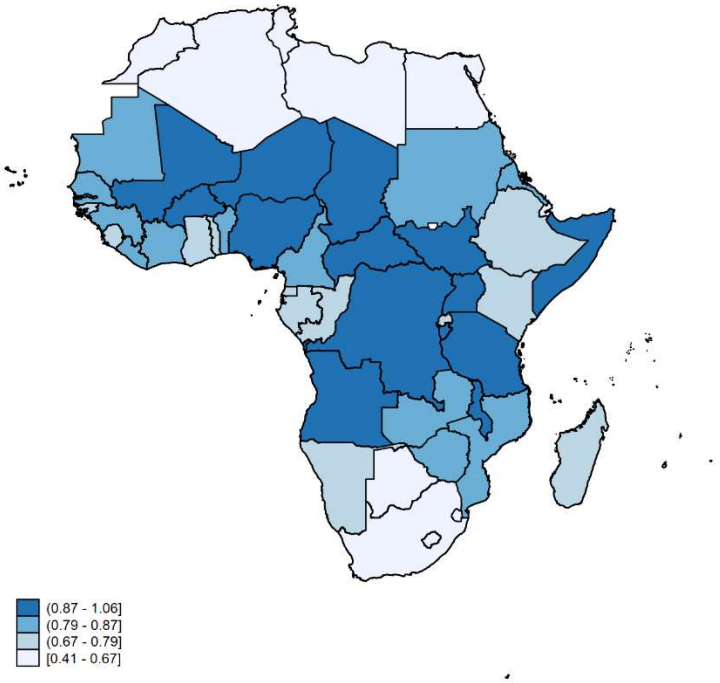
In its second part - 2nd graph of the figure - the secondary sector contributed a volume of 12.34% of GDP in value added in 1991, followed by 12.16% in 2005 and finally 11.37% in 2019 (WDI, 2022). This trend is also in decline in the manufacturing sector. The contribution of the manufacturing sector was marked by strong growth in the interval 1991-1992, then experienced a recession from 1992 to 1996, before a recovery from 1996 to 2002, to exhibit a fall again from 2002 to 2010, and finally record a certain stability from 2010 to the present. This entire period is characterized by political instabilities and financial crises which justify this downward trend. And finally, in its third part - 3rd graph of the figure - the contribution of services represented a volume of 43.68% of GDP in value added in 1991, then 43.78% in 2005 and finally 47.80% in 2019 (WDI, 2022). It is the only sector, in view of this trend, which is exhibiting improvements throughout this period. This can be explained by the fact of an increase

in technical progress with information and communication technologies (ICT) where the digital age seems to have become an alternative for the economic development of African nations. From this observation, it would be important to question the sources of this support through the demographic dividend.

4.2. The demographic dividend is declining in Africa

In the light of the discussed stylized facts in the preceding section, it is essential to study the evolution of the demographic dividend, especially within the remit of Africa. Countries whose dependency ratio is between [0.87 - 1.06], [0.79 - 0.87], [0.67 - 0.79] and [0.41 - 0.67] are characterized by very high, high, medium and low dependency ratios, respectively, as shown in Figure 2. According to the theory of demographic transition (Cowgill, 1963), African countries should be in the lower class of countries with a low dependency rate to be able to benefit from a demographic dividend. Overall, Africa's dependency ratio is decreasing significantly, as it follows a downward trend. This development heralds a new era for Africa (UNFPA, 2019). The dependency ratio peaked at 0.94 units in 1991, then fell to 0.84 units in 2005 and 0.77 units in 2019, indicating that Africa has already started to realize the first phase of the demographic dividend (WDI, 2022). When the age structure of the population varies, it causes changes in the balance between the number of people who produce and the number of people who consume. Countries with very young or very old populations have fewer producers than consumers. On the other hand, in countries characterized by age structures with high concentrations of high-producing ages during the transition from young to old population, if the corresponding growth rate of the support ratio is negative, the changes of the support ratio have the direct effect of stifling economic growth (Mason et al., 2017).

Figure 2. Mapping the dependency rate in Africa



Source: Authors from WDI (2022)

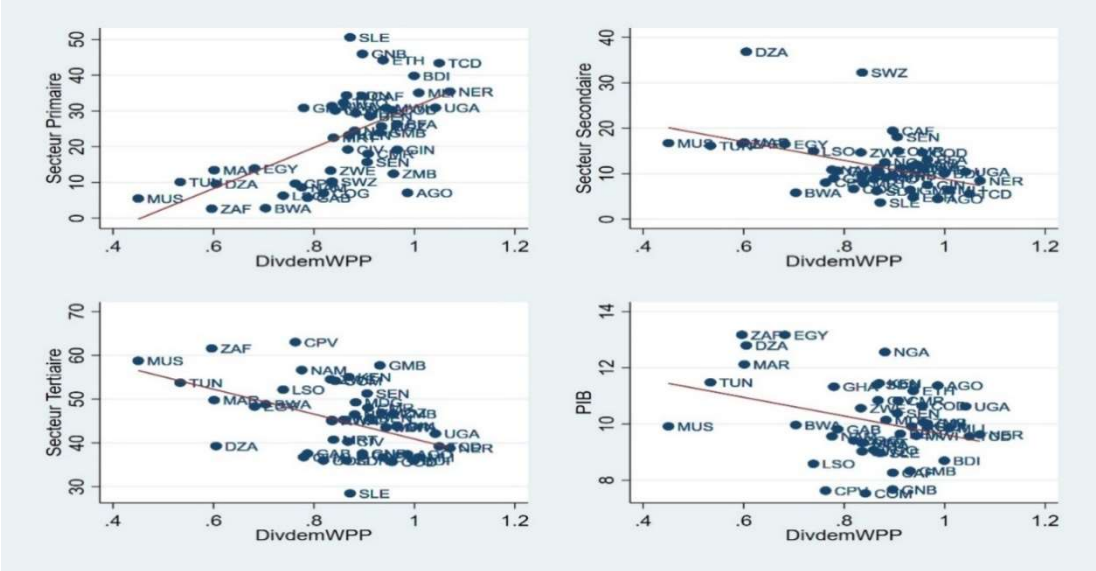
4.3. Link between the demographic dividend and economic growth in Africa: an overview of the correlation

Figure 3 shows that the demographic dividend has a negative correlation with the evolution of economic growth in terms of production in Africa, which is in line with the conviction of Mason et al. (2017) that the demographic dividend hinders economic growth. The demographic dividend shows a positive correlation with the primary sector - in the first graph - which can be elicited by the perspective that in Africa, many economies are still supported by this sector, mainly through the production of raw materials (Ausseur et al., 2017). The other two sectors, including the secondary and tertiary sectors, all show a negative correlation.

With respect to the theory of demographic transition, a low dependency rate is synonymous with strong economic growth. According to the graphs in this figure, this rule does not apply to all African economies. Some economies have a high dependency ratio with low economic growth, while others have a low dependency ratio with low economic growth, which is consistent with the neutralist philosophy of demographic transition (Sachs et al., 1995; Kelley, 2000).

Taken overall in its last graph, the figure shows a negative correlation suggesting that African economies are heterogeneous. This can be explained by the fact that some economies take into account - in addition to obtaining a considerable proportion of the working age population - the level of education, strategic investments in health, economic policies and quality institutions (Bloom et al., 2009; United Nations, 2013; UNFPA, 2019).

Figure 3. Correlation between the demographic dividend and economic growth in terms of production in Africa



Source: Authors from WDI (2022)

5. Empirical results

5.1. Basic results

Table 4 shows the findings of the impact of the demographic dividend on economic prosperity in Africa using ordinary least squares (OLS), fixed effects (FE) and random effects (RE) estimators. The results obtained by the OLS show that the demographic dividend has negative and statistically significant effect at the 1% threshold on economic growth in Africa. This result implies that a variation in the demographic dividend of 1 unit would result in a decline in economic growth in Africa of 2.933%. This result is in line with the work of Vimard and Fassassi (2011) and consistent with the conclusion of the pessimistic school according to which, the demographic dividend negatively affects economic growth.

As for other control variables, human capital has statistically significant positive effects on economic growth in Africa at the 1% level of significance. This implies that an improvement in human capital by on unit promotes economic growth in Africa by 1.050%. As for trade openness, it is negatively linked with economic growth in Africa at a significance level of 1%. As for the rents from natural resources, it has positive and statistically significant effects on economic growth at a significance level of 1%. This result implies that an increase in natural resource rent by 1% would lead to an improvement in economic growth in Africa by 0.331%. As for foreign direct investment (FDI), it also has positive and statistically significant effect on economic growth in Africa at a significance level of 5%. This means that a 5% change in FDI would result in a corresponding change in economic growth in Africa of 0.0192%. Financial development is positively linked to economic growth at 1% significance level. This result suggests that an improvement in financial development in Africa by 1% promotes economic growth in Africa by 0.0199%. Final government consumption expenditure has negative and statistically significant effect on economic growth in Africa at a significance level of 1%. This result implies that a variation in final government consumption expenditure of 1% induces a drop in economic growth in Africa of -0.0444%. *Ceteris paribus*, without claiming to be exhaustive, these results could indicate problems such as multicollinearity, omitted variables or measurement errors, heteroscedasticity, *inter alia*. However, the use of fixed and random effects estimators, according to the literature, is necessary to guarantee the quality of these results. The fixed effects estimator is the best alternative, following the Hausman test.

Table 5 presents the results of the effect of the demographic dividend on sectoral economic growth in Africa via ordinary least squares (OLS), fixed effects (FE) and random effects (RE) estimators; presented in Columns 1-3, 4-6 and 7-9, respectively. Columns 1-3 present the specificity of the analysis between our independent variable of interest and the other control variables, in order to capture the different variations. We observe that the demographic dividend positively affects the primary sector in Africa at a significance level of 1%.

This result implies that a 1 unit increase in demographic dividend induces an improvement in the volume of the primary sector by 0.595%. Furthermore, regarding the secondary sector, it affects it negatively at a significance level of 1%. This implies that a 1unit variation in the demographic dividend induces a decrease in the volume of the secondary sector by -1.528%.

Moreover, regarding the tertiary sector, it has a positive impact at a significance level of 1%. This result suggests that an improvement in the demographic dividend of 1unit would lead to an increase in the volume of services in Africa by 0.191%.

As with the other control variables, with regard to human capital, it has contrasting effects. In the primary sector, it is negatively associated at a significance level of 1%. And in the two other sectors - among others secondary and tertiary - it presents a variation of sign and becomes positive and significant at the same threshold in the tertiary sector while in the secondary sector, it is not significant. As for trade openness, the results suggest that it contributes negatively and significantly at a threshold of 1% in both sectors, including the primary and tertiary sectors, while it loses its significance in the secondary sector. Natural resource rent is also negatively associated with the primary sector in Africa at a 10% level of significance, while in the secondary and tertiary sectors retains their negative contribution but become significant at a 1% level. FDI in turn has a negative contribution to the secondary sector at a significance level of 1%, but its sign varies and then lose its significance in other sectors. The contribution of financial development is negatively associated with the primary sector but positively with the other two sectors respectively at a 1% level of significance for the primary and tertiary sectors, and 10% for the secondary sector. The government's final consumption expenditure is negatively associated with the primary sector at the 1% significance level and positively associated with the secondary and tertiary sectors at the same significance level. The general rise in prices is positively associated with the primary sector at a significance level of 5% in the continent, but changes sign and loses its significance in the other two sectors. The size of the informal sector is negatively associated with the primary sector at a significance level of 1% in Africa and is positively associated with the tertiary sector at a significance level of 10%, losing its significance in favor of the secondary sector. Finally, governance exhibits a negative contribution at the 1% significance level in the primary and secondary sectors in Africa, and becomes positively associated with the tertiary sector at the same significance level as the other two sectors.

All things being equal, without claiming to be exhaustive, these results can be justified by the fact that the majority of African economies are still supported by the primary sector, which is in consistent with the work of Ausseur et al. (2017). According to UNFPA (2019), some African countries have yet to realize the demographic dividend and for others, achieving the demographic dividend already supports inclusive economic growth. These results are consistent with the hypothesis that changing age characteristics play a substantial role in a nation's economic performance (Bloom and Williamson, 1998; Cruz and Ahmed, 2018b; Jafrin et al., 2021). It worthwhile to note that concerns pertaining to robustness in the findings, especially as it pertains to issues related to *inter alia*, the observed heterogeneity and reverse causality or simultaneity, can be addressed by estimation techniques such as the fixed effects and instrumental variables regressions, as in discussed in the subsequent sections. The fixed effects estimator is the best alternative, according to the Hausman test in the appendix.

Table 4. Effect of the demographic dividend on economic growth in Africa.

	Dependent variable GDP per capita Production approach (Penn100) lncgdpo								
VARIABLES	OLS			EF			EA		
DivdemWPP	-3.432***	-2.829***	-2.933***	-3.914***	-0.472**	-0.778***	-3.907***	-0.476**	-0.777***
	(0.272)	(0.454)	(0.504)	(0.161)	(0.206)	(0.257)	(0.160)	(0.206)	(0.256)
Humcap		1.199***	1.050***		0.645***	0.461***		0.649***	0.474***
		(0.117)	(0.153)		(0.0874)	(0.0949)		(0.0870)	(0.0943)
Trade Openness		-1.179***	-1.228***		-0.0963**	-0.0359		-0.105**	-0.0437
		(0.121)	(0.142)		(0.0478)	(0.0493)		(0.0479)	(0.0495)
Natresrents		0.306***	0.331***		0.0272	0.00878		0.0353	0.0165
		(0.0236)	(0.0384)		(0.0233)	(0.0233)		(0.0231)	(0.0232)
FDI		0.0223**	0.0192**		0.0116***	0.00757***		0.0117***	0.00760***
		(0.00873)	(0.00954)		(0.00205)	(0.00186)		(0.00207)	(0.00188)
Findev		0.0203***	0.0199***		0.000525	-0.00124		0.00101	-0.000724
		(0.00182)	(0.00249)		(0.00125)	(0.00138)		(0.00125)	(0.00138)
GFCE		-0.0414***	-0.0444***		0.00430	0.00500		0.00339	0.00401
		(0.00573)	(0.00848)		(0.00332)	(0.00344)		(0.00333)	(0.00346)
lnInflation		0.0241	0.0393		-0.0284***	-0.0201**		-0.0287***	-0.0203**
		(0.0300)	(0.0410)		(0.00867)	(0.00955)		(0.00873)	(0.00962)
Informalsector		0.00677	0.00983		-0.0501***	-0.0478***		-0.0493***	-0.0471***
		(0.00560)	(0.00651)		(0.00352)	(0.00351)		(0.00352)	(0.00351)
Governance			0.0749			0.00514			0.00430
			(0.114)			(0.0502)			(0.0503)
Constant	13.04***	14.62***	15.10***	13.45***	11.59***	11.93***	13.44***	11.63***	11.96***
	(0.245)	(0.814)	(0.912)	(0.137)	(0.381)	(0.408)	(0.243)	(0.422)	(0.451)
Observations	1,276	717	532	1,276	690	513	1,276	690	513
Fixed time effects	No	No	No	No	Yes	Yes	No	No	No
Random time effects	No	No	No	No	No	No	No	Yes	Yes
R-squared	0.129	0.559	0.544	0.325	0.738	0.728			

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Humcap: Human capital. Natresrents: Natural resource rents. GE: Government effectiveness. CC: Corruption-Control. PL: Political Stability. RQ: Regulatory Quality. RL: Rule of Law. VA: Voice & Accountability. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. DivdemWPP: is the demographic dividend obtained using the World Population Prospect formula.

Source : Authors

Like the OLS estimation results in Table 4, the fixed effects estimates in Columns 4 to 6 also indicate that the demographic dividend significantly affects the primary, secondary and tertiary sectors. For the primary sector, it is positively associated with a significance level of 1%. This means that a 1unit change in the demographic dividend would engender a corresponding 1.245%change in the primary sector in Africa. On the other hand, the impact of the demographic dividend on the secondary and tertiary sectors is negatively associated with a significance threshold of 1%. The results suggest that a change in the demographic dividend of 1unit induces a reduction in the secondary sector by -1.460%and a drop in the volume of services by -0.706%. However, all things being equal and without claiming to be exhaustive, due to the high statistical significance, while the demographic dividend contributes more to the primary sector in Africa, the corresponding contributions are yet to be apparent in secondary and tertiary sectors. These dynamics results are consistent with the findings of Canning (2011).

For the other control variables, we observe that human capital is negatively associated with the primary and secondary sectors at a significance level of 1%. For the primary sector, a change in human capital of 1unit results in a reduction in the primary sector of 0.0287%. Furthermore, for the secondary sector, the modification of human capital by 1 unit leads to an unfavorable variation of -0.385%. These results are in line with the works of Pinckney (1995) and Huffman (2001), and are also in line with Wonyra (2018). Indeed, Africa benefits little from its human capital given the low qualifications of human resources and the significant weight of the informal sector which constitutes majority of workforce (Nubukpo and Samuel, 2017). As for trade openness, it changes sign and becomes positively associated with the primary sector at a 1% level of significance and retains its negative contribution to the secondary and tertiary sectors at the same level of significance. For the primary sector, this result shows that a 1% improvement in trade openness leads to a corresponding change of 0.0955%in the primary sector. On the other hand, for the secondary and tertiary sectors, its variation of 1% would lead to a reduction in the secondary sector by -0.217%and a drop in the volume of services by -0.108%. These results can be justified by the fact that the majority of African economies are dependent on imports and the sale of raw materials in corresponding economies, which slows-down the industrialization process (Nkoa, 2016; Ausseur et al., 2017).

Table 5. Effect of the demographic dividend on sectoral growth in Africa.

	OLS			Fixed Effects			Random Effects		
VARIABLES	Primary Sector			Secondary Sector			Tertiary Sector		
DivdemWPP	0.595***	-1.528***	0.191***	1.245***	-1.460***	-0.706***	1.259***	-1.560***	-0.379***
	(0.182)	(0.270)	(0.0645)	(0.174)	(0.285)	(0.172)	(0.171)	(0.273)	(0.146)
Humcap	-1.011***	-0.0982	0.135***	-0.287***	-0.385***	0.0314	-0.316***	-0.366***	0.0908**
	(0.0561)	(0.0696)	(0.0225)	(0.0545)	(0.0892)	(0.0549)	(0.0536)	(0.0850)	(0.0452)
Trade Openness	-0.173***	-0.0263	-0.0666***	0.0955***	-0.217***	-0.108***	0.0865***	-0.205***	-0.114***
	(0.0507)	(0.0772)	(0.0138)	(0.0190)	(0.0541)	(0.0182)	(0.0191)	(0.0531)	(0.0174)
Netresrents	-0.0238*	-0.0408***	-0.0456***	-0.0129	-0.0409**	-0.0945***	-0.0123	-0.0460**	-0.0741***
	(0.0136)	(0.0146)	(0.00555)	(0.0127)	(0.0205)	(0.0122)	(0.0126)	(0.0198)	(0.0107)
FDI	-0.00148	-0.0177***	0.00130	-6.67e-05	0.00518**	0.00356***	9.65e-05	0.00446**	0.00367***
	(0.00393)	(0.00473)	(0.00117)	(0.00140)	(0.00216)	(0.00132)	(0.00141)	(0.00216)	(0.00132)
Findev	-0.00542***	0.00196*	0.00262***	-0.000691	-0.00715***	-0.00151	-0.000888	-0.00592***	-0.00117
	(0.00116)	(0.00100)	(0.000238)	(0.00102)	(0.00157)	(0.000977)	(0.00100)	(0.00149)	(0.000800)
GFCE	-0.0206***	0.0141***	0.00582***	0.000263	-0.00404	0.0113***	-0.000152	-0.00301	0.00956***
	(0.00347)	(0.00330)	(0.00111)	(0.00223)	(0.00393)	(0.00219)	(0.00222)	(0.00384)	(0.00199)
lnInflation	0.0422**	-0.0131	-0.00536	0.0420***	0.00894	-0.000896	0.0406***	0.0114	-0.00261
	(0.0174)	(0.0197)	(0.00780)	(0.00709)	(0.0109)	(0.00674)	(0.00714)	(0.0109)	(0.00662)
Informalsector	-0.00926***	0.00402	0.00213*	0.00760***	0.000931	-0.00385*	0.00671***	0.00130	-0.00281
	(0.00228)	(0.00302)	(0.00109)	(0.00193)	(0.00336)	(0.00199)	(0.00193)	(0.00328)	(0.00182)
Governance	-0.202***	-0.283***	0.0701***	-0.0722**	-0.241***	0.137***	-0.0958***	-0.210***	0.112***
	(0.0513)	(0.0459)	(0.0191)	(0.0348)	(0.0568)	(0.0332)	(0.0344)	(0.0548)	(0.0291)
Constant	5.456***	3.482***	3.560***	1.524***	5.266***	4.970***	1.599***	5.237***	4.574***
	(0.326)	(0.514)	(0.115)	(0.238)	(0.409)	(0.231)	(0.251)	(0.407)	(0.201)
Observations	710	677	700	710	653	676	710	653	676
Time Fixed Effects	No	No	No	Yes	Yes	Yes	No	No	No
Random Fixed Effects	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.702	0.208	0.378	0.413	0.166	0.307			

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Notes: The primary sector is represented by the value added as a % of GDP from agriculture, forestry and fishing; the secondary sector is represented by the value added of the manufacturing industry as a % of GDP; and the tertiary sector is represented by the value added of services as a % of GDP.

Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. DivdemWPP: is the demographic dividend obtained using the World Population Prospect formula.

Source: Authors

At the 5% and 1% significance levels, resource rents are inversely correlated with the secondary and tertiary sectors, respectively. A variation of 1% in the secondary sector translates into a decrease of -0.0409%. Likewise, a variation of 1% in the tertiary sector translates into a drop of -0.0945% in the volume of services. The natural resource curse phenomena can explain this tendency (Sachs and Warner, 1995; Carbonnier, 2007; Tcheta-Bampa and Kodila-Tedika, 2018; Shobande and Asongu, 2023). Indeed, in several African countries where enormous revenues are earned from the exploitation of basic minerals, the majority of the population is often impoverished and precarious. Furthermore, unproductive public spending is increasing, generally due to the desire to maintain social peace in the face of rising inequality (Nchofoung et al., 2021).

Foreign direct investments (FDI) contribute positively to the secondary and tertiary sectors at a respective significance levels of 5% and 1%. This translates, for the secondary sector, to the fact that a 1% change in FDI results in a corresponding increase in the secondary sector of 0.00518%. Similarly, with regard to the tertiary sector, the 1% variation in FDI leads to an increase in the volume of services in Africa by 0.00356%. These results are in agreement with the work of Nkoa (2016) and join those of Gupta and Chand (2021). Indeed, for UNCTAD (2022), African countries have reached a record level of $83 billion in FDI which contributes to the economic growth of their nations. Regarding financial development, it is negatively associated with the secondary sector at 1% significance level. This indicates that a 1% variation in financial development induces a decrease in the secondary sector of -0.00715units. This result is consistent with the work of Adeoye et al. (2020) which indicates that financial development indirectly contributes to industrialization due to this negative association in our results. Government final consumption expenditure is positively associated with the tertiary sector at a significance level of 1%. This result indicates that its 1% improvement leads to a corresponding change in the tertiary sector of 0.0113%. Indeed, this is consistent with the hypothesis that individuals' desire for services and willingness to pay are elastic with respect to income, and therefore that the expansion of the public economy is affected by a nation’s economic wealth (Cameron, 1978; Shonchoy et al., 2010).

Our results on general price increases (i.e., inflation), suggest a positive association with the primary sector at a significance level of 1%. This indicates that a 1% improvement in inflation results in a corresponding change of 0.0420%in the primary sector. These results are in agreement with Schertz and Harrington (1981) and join the work of Aye and Odhiambo (2021) who maintain that a given inflation threshold is necessary for the latter to positively influence the primary sector and for the variation in prices in economies changes for various reasons besides inflation. Regarding the weight of the informal sector, it has a positive link with the primary sector at a significance threshold of 1%, on the other hand for the tertiary sector, it is negatively associated at a significance threshold of 10%. These results indicate that, for the primary sector, an improvement in the weight of the informal sector of 1 unit leads to a corresponding change in the primary sector of 0.00760%. While for the tertiary sector, its modification of 1% leads to a drop in the volume of services in Africa by -0.00385%. These results are in line with the research of Medina and Schneider (2019). In a similar spirit, Benjamin et al. (2014) and Niokhor (2021) argue that African economies should not distinguish

between the formal and informal sectors because the informal sector is not easy to distinguish from the formal sector. Furthermore, several governments have expressed interest in the motivation, performance and size of the informal sector, particularly where the latter provides livelihoods and employment to a significant portion of the population, a situation which admittedly, escapes government control (Schneider and Enste, 2000; Medina and Schneider, 2018).

Finally, with regard to governance, with a significance level of 5% and 1%, it has a negative impact on the primary and secondary sectors. At the 1% significance level, it is favorably associated with the tertiary sector. These results show that, in the primary sector, a change in governance of 1 unit leads to a reduction of 0.0722% in the primary sector. Then, for the secondary sector, a change of 1unit results in a decrease of -0.241% in the secondary sector. Finally, an increase of 1 unit of governance in the tertiary sector leads to an increase of 0.137% in services. Several arguments can be put forward to justify this conclusion, all things being equal, without claiming to be exhaustive. Firstly, government support - the use of public subsidies - could have a negative impact on farms due to the unique nature of the operation of the primary sector - the agricultural industry - which is influenced by elements that affect agricultural businesses. Furthermore, the industrialization process in Africa is stagnating due to numerous obstacles linked to political instabilities - insufficient protection of property rights. Finally, if African countries want to achieve significantly higher growth rates, they will need to use a growth model different from previous miracles based on industrialization. This could be service-led growth (Rodrik, 2018; Pruntseva et al., 2021).

5.2. Robustness analyses.

We have so far demonstrated that the demographic dividend has a negative impact on the sectoral economic growth of African countries. We further perform five robustness tests to ensure the validity of these results: the first uses a different measure of the demographic dividend, the second modifies the estimation technique, the third takes into account nations rich in natural resources, the fourth adds the context of legal origin and the fifth examines the dynamic nexus between the demographic dividend and economic growth in Africa.

5.2.1. Robustness by changing the measurement of the demographic dividend

The results of the OLS and Fixed Effects estimations compiled in Table 6 show stability of the coefficients of the basic model. For OLS, the demographic dividend always positively and significantly influences the primary and secondary sectors. And for fixed effects, it always positively and significantly influences the primary sector, as well as the secondary and tertiary sectors negatively and significantly. Indeed, according to Bloom et al. (2017), Africa has potential gains from the demographic dividend but these results raise doubts.

Table 6. Effect of the demographic dividend on sectoral growth in Africa.

	OLS			Fixed Effects			Random Effects		
VARIABLES	Primary sector			Secondary sector			Tertiary sector		
Divdem	1.632***	-1.499***	0.250***	1.161***	-1.365***	-0.604***	1.261***	-1.525***	-0.244*
	(0.131)	(0.242)	(0.0654)	(0.178)	(0.284)	(0.174)	(0.172)	(0.265)	(0.137)
Humcap	-0.784***	-0.118*	0.153***	-0.328***	-0.332***	0.0665	-0.344***	-0.327***	0.116***
	(0.0538)	(0.0696)	(0.0233)	(0.0529)	(0.0849)	(0.0527)	(0.0517)	(0.0809)	(0.0439)
Trade Openness	-0.114***	-0.0971	-0.0610***	0.100***	-0.246***	-0.112***	0.0910***	-0.239***	-0.117***
	(0.0355)	(0.0748)	(0.0139)	(0.0191)	(0.0541)	(0.0182)	(0.0191)	(0.0531)	(0.0175)
Natresrents	-0.0263**	-0.0528***	-0.0450***	-0.0189	-0.0317	-0.0914***	-0.0179	-0.0367*	-0.0736***
	(0.0125)	(0.0140)	(0.00553)	(0.0127)	(0.0205)	(0.0122)	(0.0126)	(0.0198)	(0.0107)
FDI	-0.00319	-0.0155***	0.00109	-0.000448	0.00558**	0.00370***	-0.000377	0.00506**	0.00368***
	(0.00376)	(0.00468)	(0.00116)	(0.00141)	(0.00218)	(0.00133)	(0.00142)	(0.00217)	(0.00132)
Findev	-0.00286***	0.00159	0.00279***	-0.00152	-0.00616***	-0.00108	-0.00166*	-0.00505***	-0.000914
	(0.00107)	(0.000993)	(0.000259)	(0.00102)	(0.00157)	(0.000974)	(0.000995)	(0.00148)	(0.000790)
GFCE	-0.0157***	0.0131***	0.00642***	0.000843	-0.00359	0.0111***	0.000491	-0.00275	0.00957***
	(0.00290)	(0.00329)	(0.00117)	(0.00224)	(0.00394)	(0.00220)	(0.00223)	(0.00383)	(0.00201)
lnInflation	0.0559***	-0.0185	-0.00372	0.0409***	0.0106	-0.000129	0.0398***	0.0124	-0.00223
	(0.0165)	(0.0198)	(0.00779)	(0.00713)	(0.0110)	(0.00675)	(0.00716)	(0.0109)	(0.00664)
Informalsector	-0.0109***	0.00313	0.00212**	0.00804***	-0.000252	-0.00428**	0.00697***	0.000203	-0.00334*
	(0.00199)	(0.00314)	(0.00105)	(0.00194)	(0.00332)	(0.00199)	(0.00192)	(0.00322)	(0.00180)
Governance	-0.217***	-0.295***	0.0694***	-0.0723**	-0.237***	0.139***	-0.0944***	-0.212***	0.111***
	(0.0482)	(0.0471)	(0.0186)	(0.0350)	(0.0569)	(0.0333)	(0.0345)	(0.0548)	(0.0292)
Constant	3.984***	3.758***	3.458***	1.735***	5.116***	4.801***	1.731***	5.165***	4.422***
	(0.259)	(0.492)	(0.125)	(0.227)	(0.401)	(0.218)	(0.238)	(0.397)	(0.190)
Observations	710	677	700	710	653	676	710	653	676
Fixed Time Effects	No	No	No	No	Yes	Yes	No	No	No
Random Time Effects	No	No	No	No	No	No	No	Yes	Yes
R-squared	0.737	0.219	0.384	0.406	0.162	0.302			

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Notes: The primary sector is represented by the value added as a % of GDP from agriculture, forestry and fishing; the secondary sector is represented by the value added of the manufacturing industry as a % of GDP; and the tertiary sector is represented by the value added of services as a % of GDP.

Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.

Sources: Authors

5.2.2. Robustness by change of the estimation technique

Table 7 presents the relevance of the demographic dividend on sectoral economic growth in Africa. The adopted two-stage least squares (DMC/IV-2SLS) technique corrects for estimation issues such as measurement error, autocorrelation, heteroscedasticity, and reverse causality bias. However, the quality of the instruments selected here determines the performance of the DMC/IV-2SLS estimator. This is confirmed by Hansen's (1982) over-identification test which, under the null hypothesis, concludes that the instruments used are valid.

Table 7. Effect of the demographic dividend on sectoral growth in Africa

	DMC (IV-2SLS)		
VARIABLES	Primary Sector	Secondary Sector	Tertiary Sector
Divdem	1.318***	-1.387***	0.264***
	(0.214)	(0.389)	(0.0857)
Humcap	-0.881***	0.0273	0.176***
	(0.0795)	(0.110)	(0.0284)
Trade Openness	-0.175***	-0.105	-0.0306*
	(0.0599)	(0.110)	(0.0174)
Natresrents	-0.0200	-0.0440***	-0.120***
	(0.0206)	(0.0168)	(0.0143)
FDI	-0.00208	-0.0178***	0.00262*
	(0.00511)	(0.00613)	(0.00143)
Findev	-0.00326*	0.000641	0.00316***
	(0.00170)	(0.00145)	(0.000387)
GFCE	-0.0195***	0.0177***	0.00507***
	(0.00463)	(0.00518)	(0.00153)
lnInflation	0.000831	-0.000624	-0.000215
	(0.00127)	(0.00150)	(0.000314)
Informalsector	-0.0106***	0.00208	0.00267**
	(0.00337)	(0.00443)	(0.00131)
Governance	-0.167**	-0.379***	0.0120
	(0.0817)	(0.0730)	(0.0260)
Constant	4.799***	3.341***	3.389***
	(0.415)	(0.790)	(0.167)
Observations	510	496	678
R-squared	0.728	0.270	0.416

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment.
Findev: Financial Development. GFCE: Government Final Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.

Sources: Authors

The models were re-estimated by the DMC/IV-2SLS taking into account some dimensions of endogeneity such as reverse causality and/or simultaneity. The probability associated with the Hansen statistic (p-value) for all models is above the 5% threshold, indicating the validity of our instruments and the convergence of the two-stage least squares (IV-2SLS) estimator. We

find similar results with the OLS estimator. The primary and tertiary sectors are positively and deeply impacted by the demographic dividend. On the other hand, it has a major and unfavorable relationship with the secondary sector. This is logical given the importance of the informal sector for African countries (Ausseur et al., 2017; Niokhor, 2021).

According to Velnampy and Achchuthan (2014), different sectors each have a disparate contribution to economic growth. Table 8 presents the impact of the demographic dividend on African economic growth. The results show that even considered collectively, the demographic dividend is strongly and negatively correlated with a threshold of 1%.

Table 8. Effect of the demographic dividend on economic growth in Africa.

Dependent variable GDP per capita Production approach (Penn100) lncgdpo

VARIABLES	DMC(IV-2SLS)		
Divdem	-2.573***	-1.747***	-1.735**
	(0.234)	(0.564)	(0.788)
Humcap		1.034***	1.027***
		(0.132)	(0.178)
Trade Openness		-1.284***	-1.286***
		(0.190)	(0.253)
Natresrents		0.312***	0.319***
		(0.0264)	(0.0387)
FDI		0.0164*	0.0162
		(0.00940)	(0.0118)
Findev		0.0224***	0.0223***
		(0.00257)	(0.00352)
GFCE		-0.0439***	-0.0442***
		(0.00801)	(0.0106)
lnInflation		0.0153*	0.0153*
		(0.00823)	(0.00853)
Informalsector		0.00253	0.00308
		(0.00747)	(0.0108)
Governance			0.0438
			(0.162)
Constant	12.13***	14.50***	14.51***
	(0.199)	(1.314)	(1.783)
Observations	1,267	455	455
R-squared	0.097	0.512	0.512

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.

Sources: Authors

5.2.3. Robustness by observing the role of natural resources

Table 9 demonstrates that when we examine countries rich in natural resources, our variable of interest does not change in sign and that natural resource rents positively contribute to economic growth in terms of production in Africa. These results are consistent with those of Ben-Salha et al. (2018).

Table 9. Effect of the demographic dividend on economic growth in Africa.

Dependent variable GDP per capita Production approach (Penn100) lncgdpo		
VARIABLES	DMC (IV-2SLS)	
Divdem	-3.686***	-3.358***
	(0.548)	(0.642)
Humcap	0.844***	0.898***
	(0.213)	(0.264)
Trade Openness	-1.884***	-2.057***
	(0.184)	(0.216)
Natresrents	0.310***	0.420***
	(0.0593)	(0.0915)
FDI	0.0137	0.00942
	(0.00924)	(0.0105)
Findev	0.0140***	0.0151***
	(0.00227)	(0.00264)
GFCE	-0.0844***	-0.0798***
	(0.0130)	(0.0186)
lnInflation	-2.74e-05***	-0.00150
	(7.40e-06)	(0.00186)
Informalsector	-0.0117	-0.00359
	(0.00759)	(0.00879)
Governance		0.0941
		(0.165)
Constant	20.16***	20.01***
	(1.262)	(1.576)
Observations	342	264
R-squared	0.578	0.549

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.
Sources: Authors

5.2.4. Robustness by taking into account legal origin

Identifying the link between institutional quality and economic growth has given rise to a well-defined body of scholarship on how good institutions are created. It can be argued that when the rule of law exists, high-quality institutions develop because the rule of law facilitates the development of other institutional branches of a nation (North et al., 2009; Nattinger and Hall, 2012). By observing the consideration of the legal origin presented in Table 10, the results show that the demographic dividend always acts negatively and significantly on economic growth in Africa, whether in the consideration of Civil law or Common Law. Notwithstanding this negative contribution, the results show that African Common law nations tend to take measures or better take care of their human capital since this variable is positively and significantly associated with economic growth in Africa (La Porta et al., 2008).

Table 10. Effect of the demographic dividend on economic growth in Africa.

Dependent variable GDP per capita Production approach (Penn100)				
	DMC (IV-2SLS)			
VARIABLES	Civil Law		Common Law	
Divdem	-4.193***	-2.960**	-3.338***	-3.492***
	(1.167)	(1.386)	(1.025)	(0.762)
Humcap	-0.0297	0.272	1.660***	1.693***
	(0.367)	(0.431)	(0.357)	(0.356)
Trade Openness	-0.842**	-0.714*	-2.120***	-1.836***
	(0.330)	(0.398)	(0.304)	(0.359)
Natresrents	0.250***	0.390***	0.543***	0.518***
	(0.0511)	(0.0891)	(0.154)	(0.147)
FDI	0.0185	0.00649	-0,00516	-0,00478
	(0.0115)	(0.0117)	(0.0209)	(0.0211)
Findev	0.00876	0.00840	0.0121***	0.0138***
	(0.00622)	(0.00799)	(0.00403)	(0.00353)
GFCE	0.00441	0.000569	-0.0312**	-0.0411**
	(0.0214)	(0.0252)	(0.0158)	(0.0164)
lnInflation	4.79e-05***	0.00299*	0.0739***	0.0778***
	(1.56e-05)	(0.00154)	(0.0205)	(0.0198)
Informalsector	-0.0337***	-0.0406**	0.0307*	0.0131
	(0.0129)	(0.0172)	(0.0176)	(0.0221)
Governance		0.632		-0.508*
		(0.391)		(0.299)
Constant	17.31***	15.86***	16.10***	15.47***
	(2.272)	(2.812)	(2.058)	(1.984)
Observations	465	346	126	126
Hansen (p-value)	0.5281	0.3010	0.1704	0.1213
R-squared	0.417	0.399	0.825	0.833

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final

Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.

Sources: Authors

5.2.5. Robustness by verifying the dynamic relationship between the demographic dividend and sectoral growth in Africa

The use of lagged values of the outcome variable as instruments was employed by Arellano and Bover (1995) and Blundell and Bond (1998) to account for the problem of endogeneity in the generalized method of moments (GMM). In previous empirical research, first-difference GMM and system GMM have attracted much attention. However, Levine et al. (2000) claimed that the first-difference approach is ineffective with small sample sizes. Bond (2002) also came to the conclusion that the estimator may be biased if the data is not stationary, while system GMM can be used to obtain greater precision of the estimation result due to the use of more instruments and connections between level regression and first-difference regressions. Furthermore, the system GMM is superior because the instruments used in the level estimation are effective predictors for endogenous indicators when a random walk process characterizes the time series (Blundell and Bond, 1998).

Tables 11 and 12 summarize the sensitivity analyzes of our results with the system generalized method of moments (System-GMM). Observing Table 11 above, which presents the behavior of the demographic dividend - measured by the WPP (2019) formula - on economic growth in Africa, it is apparent that the demographic dividend negatively and significantly influences economic growth. Indeed, for Jafrin et al. (2021), the demographic dividend acts positively and significantly on the economic prosperity of South Asian Association for Regional Cooperation (SAARC) nations, which is contrary to what our results suggest for Africa in general.

Table 11. Effect of the demographic dividend on economic growth in Africa

	System GMM					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
L.lncgdpo	1.037***	1.028***	1.027***	1.025***	1.019***	1.024***
	(0.018)	(0.025)	(0.024)	(0.023)	(0.017)	(0.023)
DivdemWPP	-0.267*	-0.345**	-0.342*	-0.367**	-0.284**	-0.350***
	(0.157)	(0.164)	(0.174)	(0.166)	(0.130)	(0.126)
Humcap	-0.140**	-0.144***	-0.142***	-0.141**	-0.106*	-0.131**
	(0.061)	(0.051)	(0.044)	(0.052)	(0.056)	(0.064)
Trade Openness	0.017	0.009	0.013	0.008	0.001	0.004
	(0.026)	(0.029)	(0.021)	(0.024)	(0.019)	(0.024)
Findev	-0.001	-0.000	-0.001	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
GFCE	-0.003	-0.004	-0.004	-0.004	-0.005**	-0.004*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
Natresrents		0.006	0.006	0.007	0.003	-0.001
		(0.015)	(0.014)	(0.014)	(0.011)	(0.010)
Governance			0.009	0.007	0.024	0.014
			(0.037)	(0.039)	(0.048)	(0.044)

FDI				0.000	0.000	0.001
				(0.001)	(0.001)	(0.001)
lnInflation					-0.009	-0.005
					(0.009)	(0.011)
Informalsector						0.002
						(0.004)
Constant	0.112	0.300	0.294	0.353	0.390*	0.312
	(0.237)	(0.311)	(0.324)	(0.304)	(0.224)	(0.304)
Observations	708	708	708	708	699	699
Countries	36	36	36	36	36	36
Instruments	27	27	27	27	27	27
AR(1)	0.0108	0.0107	0.0106	0.0106	0.0137	0.0141
AR(2)	0.284	0.290	0.286	0.295	0.347	0.340
Hansen (p-value)	0.610	0.517	0.400	0.341	0.454	0.558

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.

Sources: Authors

By changing the alternative demographic dividend variable in Table 12, the sign of the demographic dividend remains unchanged. According to Epaphra and Kombe (2017), institutional quality is important for the economic growth of African nations but is not sufficient in itself.

Table 12. Effect of the demographic dividend on economic growth in Africa

	System GMM					
VARIABLES	1	2	3	4	5	6
L.lncgdpo	1.043***	1.029***	1.031***	1.026***	1.023***	1.011***
	(0.023)	(0.021)	(0.021)	(0.022)	(0.022)	(0.026)
Divdem	-0.419	-0.731*	-0.725**	-1.033**	-0.866	-0.950**
	(0.276)	(0.366)	(0.355)	(0.458)	(0.533)	(0.410)
Humcap	-0.187**	-0.223**	-0.220***	-0.232***	-0.213**	-0.110
	(0.084)	(0.088)	(0.071)	(0.080)	(0.091)	(0.192)
Trade Openness	0.002	-0.024	-0.027	-0.066	-0.045	-0.070*
	(0.039)	(0.030)	(0.033)	(0.052)	(0.066)	(0.039)
Findev	-0.001	-0.001	-0.001	-0.002	-0.001	-0.007
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.008)
GFCE	-0.004	-0.004	-0.004	-0.003	-0.005	-0.008
	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)
Natresrents		0.016	0.015	0.014	0.018	0.007
		(0.012)	(0.011)	(0.011)	(0.013)	(0.027)
Governance			0.015	0.029	0.035	0.084**
			(0.053)	(0.040)	(0.064)	(0.037)
FDI				0.002	0.002	0.002
				(0.002)	(0.002)	(0.002)

lnInflation					-0.008	-0.013
					(0.014)	(0.016)
Informalsector						-0.006
						(0.010)
Constant	0.320	0.847	0.851	1.325*	1.125	1.694*
	(0.431)	(0.505)	(0.516)	(0.675)	(0.792)	(0.835)
Observations	707	707	707	707	698	698
Countries	36	36	36	36	36	36
Instruments	27	27	27	27	27	27
AR(1)	0.0111	0.0113	0.0112	0.0107	0.0147	0.0137
AR(2)	0.296	0.321	0.325	0.408	0.427	0.540
Hansen (p-value)	0.703	0.776	0.742	0.910	0.798	0.739

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Humcap: Human capital. Natresrents: Natural resource rents. FDI: Foreign Direct Investment. Findev: Financial Development. GFCE: Government Final Consumption Expenditure. Divdem: is the demographic dividend improved by the authors, as an alternative measure.
Sources: Authors

6. Conclusions and recommendations

The effects of demographic change on economic growth and development have long constituted the sole subject of research on the relationships between demography and development (Rabier, 2020). However, given the progress of the demographic transition process in developing countries, which temporarily increases the percentage of the potentially active population in the total population, it has focused on the evolution of the age structure of the population over the last 20 years. This situation, known as the "demographic dividend", is considered a window of opportunity to boost the growth trajectory of the countries concerned.

In this perspective, this study was developed with the aim of assessing the impacts of the demographic dividend on sectoral economic growth in Africa. To do this, we first carried out a literature review in order to situate our problem in the theoretical and empirical literature. From this review, we can infer that the demographic dividend remains a topic of interest to many researchers, although the focus is primarily on economic concerns. However, the demographic dividend cannot be achieved without social implications. This is why we have paid great attention to the economic externalities of the demographic dividend in the African context. This study can be placed within the framework of a demo-economic theory based on the theory of demographic transition which, for many, serves as a general theory of population (Cowgill, 1963) due to the special attention it brings to the demographic dividend. Examining a few stylized facts for this purpose supports the conclusions that the dependency rate is generally falling and that the African population continues to grow but not at the same rate as thirty years ago.

As for the empirical analysis, it consisted of a first calculation of a measure of the demographic dividend using formulas inspired by the WPP (2019) and King et al. (2021). After calculation, we empirically analyzed under the OLS and Fixed Effect estimators, the effects of the demographic dividend on sectoral economic growth based on a panel composed of 44 African

countries over the period 1991-2019. Our results provide empirical evidence that in Africa by sector, the demographic dividend appears to contribute more to the primary sector than to the secondary and tertiary sectors. Overall, Africa is not yet enjoying its demographic dividend.

No demographic transition automatically engenders a dividend or economic benefit. However, it should be noted that the characteristics of the demographic dividend depend largely on the ability of governments to formulate and implement favorable policies tailored to provide the burgeoning young population with public commodities that are relevant to providing opportunities for employment and boosting economic productivity, among others: good governance, adequate health care and inclusive education (Zaman and Sarker, 2021).

The findings of this study have considerable policy implications for improving economic growth and development. Emphasis should be placed on policies that prioritize investment in education. To fully realize the rewards of the demographic dividend, it is essential to ensure that all young Africans have equal access to quality education. This can be achieved by focusing on the necessary technical and professional skills that match market demands. Furthermore, there is a need to promote youth entrepreneurship by implementing business-friendly policies. These policies can include tax incentives, financing facilities and easier access to markets, as well as training and support for young entrepreneurs. Additionally, policies should be put in place to promote industrialization. This can be achieved through the implementation of industrial policies aimed at diversifying the economy and encouraging the creation of manufacturing sectors. This may involve providing investment incentives in manufacturing industries, developing special economic zones, and promoting research and technological development.

Furthermore, it is essential that policies strengthen infrastructure which is essential to support sectoral growth in Africa. This can be achieved by establishing partnerships between the public and private sectors, attracting foreign investment and improving the business environment. Regional integration also plays a critical role in sectoral growth in Africa. Governments should actively promote economic and trade cooperation among African countries by removing barriers to trade and easing the free movement of people, services and good. This will create larger markets and stimulate intra-regional investments. Finally, in order to support sectoral growth in Africa, it is imperative to strengthen institutional capacities. Governments should implement measures to ensure good governance, transparency and anti-corruption policies. This will facilitate capacity building of public and private institutions, ultimately promoting the efficiency and competitiveness of economic sectors. Furthermore, these policies should aim to reduce inequalities, create employment opportunities for all, especially young people and women, and ensure equal access to essential social services such as health and education.

This study is subject to several limitations that require additional research. Future empirical work should consider other aspects of the demographic dividend as well as alternative approaches, including country-specific microeconomic approaches. Additionally, African countries were not grouped according to their income levels in this study and thus, further research in this direction would have more practical and relevant policy implications.

Appendix 1: List of countries.

Algeria	Ethiopia	Niger
Angola	Gabon	Nigeria
Benin	Gambia	Rwanda
Botswana	Ghana	Senegal
Burkina Faso	Guinea	Sierra Leone
Burundi	Guinea-Bissau	South Africa
Cabo Verde	Kenya	Sudan
Cameroon	Lesotho	Togo
Central African Republic	Madagascar	Tunisia
Chad	Malawi	Uganda
Comoros	Mali	Zambia
Congo, Dem, Rep,	Mauritania	Zimbabwe
Congo, Rep,	Mauritius	
Cote d'Ivoire	Morocco	
Egypt, Arab Rep,	Mozambique	
Eswatini	Namibia	

Sources : Authors.

Appendix 2: Differents tests.

	Primary sector				Secondary sector				Tertiary sector			
Variables	VIF	1/VIF	Breusch–Pagan/Cook–Weisberg test For heteroskedasticity	Ramsey RESET Test for omitted variables	VIF	1/VIF	Breusch–Pagan/Cook–Weisberg test For heteroskedasticity	Ramsey RESET Test for omitted variables	VIF	1/VIF	Breusch–Pagan/Cook–Weisberg test For heteroskedasticity	Ramsey RESET Test for omitted variables
DivdemWPP	3.43	0.291309			3.58	0.279231			3.55	0.281931		
Humcap	2.32	0.430770			2.37	0.421123			2.37	0.421645		
Findev	2.28	0.437776			2.31	0.433696			2.30	0.435427		
Governance	2.24	0.446969			2.26	0.442868			2.26	0.443077		
Natresrents	1.84	0.543264	chi2(1) = 5.84	F(3, 696) = 31.94	1.89	0.529168	chi2(1) = 37.78	F(3, 663) = 7.85	1.85	0.540300	chi2(1) = 1156.12	F(3, 686) = 38.86
Informalsector	1.57	0.637172	Prob > chi2 = 0.0156	Prob > F = 0.0000	1.86	0.537568	Prob > chi2 = 0.0000	Prob > F = 0.0000	1.58	0.634869	Prob > chi2 = 0.0000	Prob > F = 0.0000
Trade Openness	1.52	0.657734	H0: Constant variance	H0: Model has no omitted variables	1.58	0.633625	H0: Constant variance	H0: Model has no omitted variables	1.52	0.656486	H0: Constant variance	H0: Model has no omitted variables
GFCE	1.18	0.848707			1.33	0.753703			1.18	0.844947		
FDI	1.12	0.890565			1.22	0.821746			1.12	0.890104		
lnInflation	1.10	0.912695			1.07	0.937174			1.10	0.911717		
Mean VIF	1.86				1.95				1.88			

Sources: Authors

HAUSMAN TEST
Test of H0: Difference in coefficients not systematic chi2(19) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 45.06 Prob > chi2 = 0.0007 (V_b-V_B is not positive definite)

Sources: Authors

Appendix 3: The summary of indicators for measuring the demographic dividend and Expected signs of Control variables

N°	Name of Indicator	Explanation of measurement	Sources	Works
1	Dependency ratio	which can be broken down into two types: child dependency and elderly dependency. It is calculated by dividing the number of people aged 0-14 and 65+, by the number of people aged 15-64	World Population Prospect 2019	- Coale and Hoover (1958); - Bloom and Williamson (1998); - Baerlocher et al. (2019); - King et al. (2021) - *inter alia*
2	National transfer accounts	allow us to define a second "support ratio" indicator, use census or survey data extrapolated to match the national accounts to determine the ratio between labor income (salaried or self-employed) and consumption (private and public) over the life cycle and extrapolate it to match the national accounts for a specific date or point in time. Total transfers to dependents divided by total working-class income give the dependency burden ratio also known as the "longitudinal support ratio", which can be used to estimate the second demographic dividend (Rabier, 2020; Requier-Desjardins, 2020). In addition to the above, there is the DemDiv model used in microeconomic studies which also brings out the demographic dividend for a specific country or economy.	- Prskawetz and Sambt (2014); - Mason et al. (2017); - Dramani (2019).	- Rentería et al. (2016); - Delaunay and Guengant (2019); - *inter alia*
3	Active working population	Taken as the working-age population multiplied by human capital.	- Zaman et Sarker (2021)	- Jafrin et al. (2021) - Hosan et al. (2022) - *inter alia*

Sources: Authors

References

Abrigo, M. R., R. H. Racelis, J. Salas, A. N. Herrin, D. A. Ortiz & Z. C. Tam. 2018, «Are we missing out on the demographic dividend? trends and prospects», cahier de recherche, PIDS Discussion Paper Series.

Adeoye, B., C. I. Nwokolo & N. I. Igboanugo. 2020, «Migrant remittance inflow and industrialization in africa: What role does financial development play?», dans Financing Africa's Development, Springer, p. 191–220.

Ahmad, M. & R. E. A. Khan. 2018, «Age-structure, human capital and economic growth in developing economies: A disaggregated analysis», Pakistan Journal of Commerce and Social Sciences (PJCSS), vol. 12, no 1, p. 229–252.

Ahmad, M. & R. E. A. Khan. 2019, «Does demographic transition with human capital dynamics matter for economic growth? a dynamic panel data approach to gmm», Social Indicators Research, vol. 142, no 2, p. 753–772.

Ahmed, S., Cruz, M., Go, D. S., Maliszewska, M., & Osorio-Rodarte, I. (2014). How significant is Africa's demographic dividend for its future growth and poverty reduction?. World Bank policy research working paper, (7134).

Aiyar, S., A. Mody et al..2013, «The demographic dividend : Evidence from the indian states», dans India Policy Forum, National Council of Applied Economic Research, vol. 9, p. 105– 148.

Amna Intisar, R., M. R. Yaseen, R. Kousar, M. Usman et M. S. A. Makhdum. 2020, «Impact of trade openness and human capital on economic growth : a comparative investigation of asian countries», Sustainability, vol. 12, no 7, p. 2930.

Ampofo, G. K. M., J. Cheng, D. A. Asante & P. Bosah. 2020, «Total natural resource rents, trade openness and economic growth in the top mineral-rich countries : New evidence from Nolinear and asymmetric analysis.», Resources Policy, vol. 68, p. 101710.

Arellano, M. & O. Bover. 1995, «Another look at the instrumental variable estimation of errorcomponents models», Journal of econometrics, vol. 68, no 1, p. 29–51.

Ausseur, A., C. Vergne et al.. 2017, «La croissance de l'afrique subsaharienne : diversité des trajectoires et des processus de transformation structurelle», cahier de recherche.

Aye, G. C. et N. M. Odhiambo. 2021, «Threshold effect of inflation on agricultural growth : evidence from developing countries», Advances in Decision Sciences, vol. 25, no 2, p. 1–22.

BAD. 2018, « Rapport annuel BAD».

Baerlocher, D., Parente, S. L., & Rios-Neto, E. (2019). Economic effects of demographic dividend in Brazilian regions. The Journal of the Economics of Ageing, 14, 100198.

Balestra, P. & M. Nerlove. 1966, «Pooling cross section and time series data in the estimation of a dynamic model : The demand for natural gas», Econometrica : Journal of the econometric society, p. 585–612.

Banque Mondiale, a. 2022, «Secteurs d'activité compétitifs : Comprendre la pauvreté», .

Barro, R. J. 1995, «Inflation and economic growth», .

Benjamin, N., K. Beegle, F. Recanatini & M. Santini. 2014, «Informal economy and the world bank», World Bank Policy Research Working Paper, , no 6888.

Ben-Salha, O., H. Dachraoui & M. Sebri. 2018, «Natural resource rents and economic growth in the top resource-abundant countries : a pmg estimation», Resources Policy, p. 101229.

Bloom, D. E. & J. E. Finlay. 2009, «Demographic change and economic growth in asia», Asian Economic Policy Review, vol. 4, no 1, p. 45–64.

Bloom, D. E. & J. G. Williamson. 1998, «Demographic transitions and economic miracles in emerging Asia», The World Bank Economic Review, vol. 12, no 3, p. 419–455. ISBN : 02586770 Publisher : Oxford University Press.

Bloom, D. E., D. Canning & P. N. Malaney. 2000, «Population dynamics and economic growth in Asia», Population and development review, vol. 26, p. 257–290. ISBN : 0098-7921 Publisher : JSTOR.

Bloom D, Canning D, Sevilla J (2003) The demographic dividend: a new perspective on the economic consequences of population change. RAND Corporation: Santa Monica. [Online]. Available at: https://doi.org/10.7249/MR1274 (Accessed 11 October 2023)

Bloom, D. E., D. Canning, G. Fink & J. E. Finlay. 2009, «Fertility, female labor force participation, and the demographic dividend», Journal of Economic growth, vol. 14, no 2, p. 79–101.

Bloom, D. E., D. Canning, L. Hu, Y. Liu, A. Mahal & W. Yip. 2010, «The contribution of population health and demographic change to economic growth in china and india», Journal of Comparative Economics, vol. 38, no 1, p. 17–33.

Bloom, D. E., M. Kuhn & K. Prettner. 2017, «Africa's prospects for enjoying a demographic dividend», Journal of Demographic Economics, vol. 83, no 1, p. 63–76.

Blundell, R. et S. Bond. 1998, «Initial conditions and moment restrictions in dynamic panel data models», Journal of econometrics, vol. 87, no 1, p. 115–143.

Bond, S. R. 2002, «Dynamic panel data models : a guide to micro data methods and practice», Portuguese economic journal, vol. 1, no 2, p. 141–162.

Boserup, E. 1965, 1981, «The conditions of agriculture progress», .

Boserup, E. 1965, The conditions of agricultural growth : The Economics of Agrarian Change Under Population Pressure, G. Allen and Unwin, Aldine, London, Chicago., Routledge.

Cameron, D. R. 1978, «The expansion of the public economy : A comparative analysis», American political science review, vol. 72, no 4, p. 1243–1261.

Canning, D. 2011, «The causes and consequences of demographic transition», Population studies, vol. 65, no 3, p. 353–361.

Carbonnier, G. 2007, Comment conjurer la malédiction des ressources naturelles?, 26-2, Institut de hautes études internationales et du développement.

Céron, J.-P. 1974, «B.commoner, l'encerclement, paris, stock, 1972; p. et a. ehrlich, population, ressources, environnement, paris, fayard, 1972.», dans Annales. Histoire, Sciences Sociales, vol. 29, Cambridge University Press, p. 662–664.

Choudhry, M. T. &J. P. Elhorst. 2010, «Demographic transition and economic growth in china, india and pakistan», Economic Systems, vol. 34, no 3, p. 218–236.

Cilliers, J. (2018). Getting to Africa's demographic dividend. ISS Africa Report, 2018(13), 1-32.

Coale, A. J. & E. M. Hoover. 1958, «Population growth and economic development in low income countries : a case study of india's prospects.», cahier de recherche.

Cowgill, D. O. 1963, «Transition theory as general population theory», Social Forces, vol. 41, no 3, p. 270–274. ISBN : 1534-7605 Publisher : The University of North Carolina Press.

Cole, H. & Dubsky, M. H. (1974), L'anti-Malthus. Une critique de « Halte à la croissance », Paris, Seuil.

Cruz, M. & S. A. Ahmed. 2018, «On the impact of demographic change on economic growth and poverty», World development, vol. 105, p. 95–106. ISBN : 0305-750X Publisher : Elsevier.

Delaunay, D., & Guengant, J. P. (2019). Le dividende démographique en Afrique subsaharienne. https://hal.science/hal-02084425/document

De Gregorio, J. & P. E. Guidotti. 1995, «Financial development and economic growth», World development, vol. 23, no 3, p. 433–448.

Ehrlich PR (1968) The population bomb. Ballantine Books, New York

Epaphra, M. & A. H. Kombe. 2017, «Institutions and economic growth in africa : Evidence from panel estimation», Business and Economic Horizons (BEH), vol. 13, no 1232-2019-723, p. 570–590.

Etsiba, S., F. N. Avouba & J. Bozongo. 2018, «Effets de la gouvernance institutionnelle sur la croissance économique : cas de la cemac», Annale des Sciences Economiques et de Gestion, vol. 18, no 1.

Feenstra, R. C., R. Inklaar & M. P. Timmer. 2015, «The next generation of the penn world table», American economic review, vol. 105, no 10, p. 3150–82.

Gauss, C. F. (1809). Theory of the motion of the heavenly bodies moving about the sun in conic sections. Werke, 7, 1–280.

Gestsson, M. H., & Zoega, G. (2016). Demographic Changes and Economic Growth. In Stagnation Versus Growth in Europe: Capitalism in the 21st Century (pp. 71-85). Springer International Publishing. https://doi.org/10.1007/978-3-319-26952-8_6

Gupta, A. et A. Chand. 2021, «Impact of fdi in a three sectors model», Available at SSRN 3873761.

Han, Q. 2019, «Research on demographic dividend, lewis turning point, saving and economic growth», International Journal of Business and Social Science, vol. 10, no 6, p. 20–34.

Hansen, L. P. 1982, «Large sample properties of generalized method of moments estimators», Econometrica : Journal of the econometric society, p. 1029–1054.

He, Y., M. Yu & Y. Hou. 2022, «Aging population, inflation and economic growth», Frontiers in Business, Economics and Management, vol. 4, no 1, p. 20–25.

Hosan, S., S. C. Karmaker, M. M. Rahman, A. J. Chapman & B. B. Saha. 2022, «Dynamic links among the demographic dividend, digitalization, energy intensity and sustainable economic growth : Empirical evidence from emerging economies», Journal of Cleaner Production, vol. 330, p. 129858.

Houdaille, J. 1973, «Ehrlichpaul r., ehrlichanne h.—population, ressources, environnement», Population, vol. 28, no 3, p. 695–696.

Huffman, W. E. 2001, «Human capital : Education and agriculture», Handbook of agricultural economics, vol. 1, p. 333–381.

IMF, F. M. I. 2019, « Perspectives pour l'économie mondiale 2019 ».

Jafrin, N., M. Mahi, M. M. Masud & D. Ghosh. 2021, «Demographic dividend and economic growth in emerging economies: Fresh evidence from the saarc countries», International Journal of Social Economics, vol. 48, no 8, p. 1159–1174.

Joseph, H. 2019, «Financial development and economical growth».

Kaufmann, D. 2007, The worldwide governance indicators project : answering the critics, vol. 4149, World Bank Publications.

Kelley, A. C. 2000, «The population debate in historical perspective : Revisionism revisited».

King, E. M., H. L. Randolph, M. S. Floro et J. Suh. 2021, «Demographic, health, and economic transitions and the future care burden», World Development, vol. 140, p. 105371.

Kuznets, S. 1967, «Population and economic growth», Proceedings of the American philosophical Society, vol. 111, no 3, p. 170–193.

La Porta, R., F. Lopez-de Silanes & A. Shleifer. 2008, «The economic consequences of legal origins», Journal of economic literature, vol. 46, no 2, p. 285–332.

Landry A., 1982 [1929], Le maximum et l'optimum de population, Scienta (réédité in Landry A., 1982 [1934], La révolution démographique. Études et essais sur les problèmes de la population, Paris, INED-Presses Universitaires de France, 205-215).

Landry, A. 1934, 1948, «La révolution démographique. Études et essais sur les problèmes de la population».

Legendre. (1805). On Least Squares [Translated from the French by Professor Henry A. Ruger and Professor Helen M. Walker. New York City: Teachers College, Columbia University.

Levine, R., N. Loayza & T. Beck. 2000, «Financial intermediation and growth : Causality and causes», Journal of monetary Economics, vol. 46, no 1, p. 31–77.

Lewis, W.A. (1954) Economic Development with Unlimited Supplies of Labour. The Manchester School of Economic and Social, 22, 139-191.

Lutz, W., J. Crespo Cuaresma, E. Kebede, A. Prskawetz, W. C. Sanderson & E. Striessnig. 2019, «Education rather than age structure brings demographic dividend», Proceedings of the National Academy of Sciences, vol. 116, no 26, p. 12798–12803.

Malthus, T. 1798, «An essay on the principle of population. printed for j. johnson», St. Paul's church-yard, London, p. 1–126.

Mason, A., R. Lee, M. Abrigo & S.-H. Lee. 2017, «Support ratios and demographic dividends : Estimates for the world», Technical Paper, , no 2017/1.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). The limits to growth: report to the Club of Rome on the critical situation of mankind (No. HC59. L42 1973.). Fondo de cultura económica.

Medina, L. & F. Schneider. 2018, «Shadow economies around the world : what did we learn over the last 20 years?», Publisher : IMF Working Paper.

Medina, L.& F. Schneider. 2019, «Shedding light on the shadow economy : A global database and the interaction with the official one», Available at SSRN 3502028.

Misra, R. 2015, «Impact of demographic dividend on economic growth : a study of brics and the eu», International Studies, vol. 52, no 1-4, p. 99–117.

Moussavou, F. 2017, «Les déterminants du chômage dans les pays en développement : Une application au cas du Congo Brazzaville», Les Cahiers du CEDIMES, p. 11.

Muchie, M. & R. Maharajh. 2011, «Lions on the move : The progress and potential of african economies, mckinsey global institute : book review», African Journal of Science, Technology, Innovation and Development, vol. 3, no 2, p. 295–298.

Mulugeta Woldegiorgis, M. (2023). Towards inclusive development through harnessing demographic dividend? Empirics for Africa. Journal of Social and Economic Development, 1-23.

Mundlak, Y. 1961, «Empirical production function free of management bias», Journal of Farm Economics, vol. 43, no 1, p. 44–56.

United Nations, Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022: Summary of Results. UN DESA/POP/2022/TR/NO. 3.

Nations Unies. 2013, «World population prospects : the 2012 revision», Population division of the department of economic and social affairs of the United Nations Secretariat, New York, vol. 18.

Nattinger, M. C. & J. C. Hall. 2012, «Legal origins and state economic freedom», Journal of Economics and Economic Education Research, vol. 13, no 1, p. 25.

Nchofoung, T. N., Achuo, E. D., & Asongu, S. A. (2021). Resource rents and inclusive human development in developing countries. Resources Policy, 74, 102382.

Niokhor, G. N. N. 2021, «Revue africaine de management-african management review», Revue africaine de management-African management review, vol. 6, no 2, p. 172–205.

Nkoa, B. E. O. 2016, «Investissements directs étrangers et industrialisation de l'afrique : un nouveau regard», Innovations, , no 3, p. 173–196.

North, D. C., J. J. Wallis, B. R. Weingastet al.. 2009, Violence and social orders : A conceptual framework for interpreting recorded human history, Cambridge University Press.

Notestein, F. W. 1945, 1950, «Population-the long view.», Food for the World., p. 36–57.

Nubukpo, K. & B. Samuel. 2017, «Entre les plans d'émergence sans vision et des visions sans émergence : la difficile appropriation par l'afrique de ses trajectoires de développement», Politique africaine, , no 1, p. 51–63.

Olabiyi, K. A. 2018, «Validating the effectiveness of demographic dividend transmission mechanisms on economic growth in nigeria», Ife Social Sciences Review, vol. 26, no 1, p. 1–12.

Ongo Nkoa, B. E. 2014, «Impact of foreign direct investment on economic growth in cemacregion : an analysis of transmission mechanisms», International Journal of Sustainable Economy, vol. 6, no 4, p. 303–326.

Osei-Appaw, A., & Christian, A. (2022). The Demographic Dividend As A Pathway To Development: The Role of Fertility and Education in Sub-Saharan Africa. A Narrative Review. International Journal of Economics, 7(1), 76-90.

Pasichnyi, M., & Nepytaliuk, A. (2021). The Contributions of Demographic Factors to Economic Growth. Problemy Ekorozwoju, 16(1), 219-229. doi: 10.35784/PE.2021.1.24

Pinckney, T. C. 1995, «Human capital and agricultural productivity», Policy and Rural Development : Two Communities in East Africa. Williams College Press. Williamstown, MA.

Pruntseva, G., N. Popadynets, M. Barna, I. Stetsiv, V. Yakubiv, L. Shymanovska-Dianych, Y. Fedotova, M. Karpiak & I. Hryhoruk. 2021, «The impact of governance on agricultural production as an exclusive factor of the country's food securit», Accounting, vol. 7, no 1, p. 75–80.

Rabier, S. 2020, «Les enjeux du dividende démographique pour les pays d'Afrique», Policy Paper, p. 1–27. Publisher : Agence française de développement.

Rentería, E., Souto, G., Mejía-Guevara, I., & Patxot, C. (2016). The effect of education on the demographic dividend. Population and Development Review, 42(4), 651-671.

Robbins, L. (1927). The optimum theory of population. London Essays in Economics in Honour of Edwin Cannan, London: Routledge.

Rodrik, D. 2018, «Anafricangrowth miracle?», Journal of African Economies, vol. 27, no 1, p. 10–27.

Sachs, J. D. & A. Warner. 1995, «Natural resource abundance and economic growth», .

Sachs, J. D., A. Warner, A. Åslund & S. Fischer. 1995, «Economic reform and the process of global integration», Brookings papers on economic activity, vol. 1995, no 1, p. 1–118.

Sadeghi, H. A. (2018). Investigating the Role of Balance of Population and Economic Growth in Achieving Sustainable Economic Growth (Case Study: Upper-Middle Income

Countries during 1985 to 2016). International Journal of Applied Research in Management and Economics, 1(2), 1-8.

Shobande, O., & Asongu, S. (2023). The dilemmas of relevance: exploring the role of Natural resources and Energy Consumption in managing climate crisis in Africa. Management of Environmental Quality: An International Journal.

Sahu, J. P. 2021, «Does inflow of foreign direct investment stimulate economic growth? evidence from developing countries», Transnational Corporations Review, vol. 13, no 4, p. 376– 393.

Samueli, J.-J. 2010, «Legendre et la méthode des moindres carrés», Bibnum. Textes fondateurs de la science.

Sánchez-Romero, M., G. Abio, C. Patxot & G. Souto. 2018, «Contribution of demography to economic growth», SERIEs, vol. 9, no 1, p. 27–64.

Sandron, F. 2002, «Les populations suivent-elles la loi des nombres anomaux?», Population, vol. 57, no 4, p. 761–767.

Sauvy, A. (1986). Julian L. Simon—L'homme, notre dernière chance. Population, 41(4), 871-872.

Schertz, L. & D. H. Harrington. 1981, «Inflation and agriculture», Agricultural-Food Policy Review, p. 60–67.

Schneider, F. & D. H. Enste. 2000, «Shadow economies : Size, causes, and consequences», Journal of economic literature, vol. 38, no 1, p. 77–114.

Sekher, T., & Govil, D. (2022). World Population Day-2022 Symposium & Launch of United Nations World Population Prospects-2022. Columbia University.

Shonchoy, A. S. et al..2010, «Determinants of government consumption expenditure in developing countries : A panel data analysis», Institute of Developing Economies (IDE) Discussion Paper, vol. 266.

Soriot, A. 2002, «Optimum de production et optimum de population : l'analyse démographique d'adolphelandry», Revue d'histoire des sciences humaines, , no 2, p. 157–179.

Tcheta-Bampa, T.-B. & O. Kodila-Tedika. 2018, «Dynamisation de la malédiction des ressources naturelles en afrique sur les performances économiques : institution et guerre froide»,.

Teitelbaum, M. S. 1975, «Relevance of demographic transition theory for developing countries», Science, vol. 188, no 4187, p. 420–425.

Thompson, W. S. 1929, 1934, «Population», .

UNCTAD. 2020, Base de données, https ://unctadstat.unctad.org/FR/, UNCTAD.

UNCTAD. 2022, Rapport 2022 sur l'investissement dans le monde de la la Conférence des Nations Unies sur le commerce et le développement (CNUCED) publié le 9 juin, UNCTAD.

UNFPA. 2019, «Programmation du dividende démogpahique : de la théorie à l'expérience», .

Velnampy, T., & Achchuthan, S. (2014). Economic Growth Structure: Sectoral Perspective. http://repo.lib.jfn.ac.lk/ujrr/handle/123456789/662

Vimard, P. & R. Fassassi. 2011, «Démographie et développement en afrique : éléments rétrospectifs et prospectifs», Cahiers québécois de démographie, vol. 40, no 2, p. 331–364.

WDI. 2020, World development indicators 2020, The World Bank.

WGI. 2020, Worldwide Governance indicators 2020, The World Bank.

Williamson, J. G. (2013). Demographic dividends revisited. Asian Development Review, 30(2), 1-25.

Wonyra, K. O. 2018, «Industrialization and economic growth in sub-saharanafrica : the role of human capital in structural transformation», Journal of Empirical Studies, vol. 5, no 1, p. 45–54.

WPP. 2019, Worldwide Population Prospect 2019, Department of Economic and Social Affairs, Population Dynamics.

Yang, F. 2019, «The impact of financial development on economic growth in middle-income countries», Journal of International Financial Markets, Institutions and Money, vol. 59, p.74–89.

Young, A. 2012, «The african growth miracle», Journal of Political Economy, vol. 120, no 4, p. 696–739.

Young, A. O. et al.. 2019, «Economic growth and demographic dividend nexus in nigeria: a vector autoregressive (var) approach», Asian Social Science, vol. 15, no 2, p. 37–59.