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Demographic Dynamics and Economic Development in Ethiopia

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics (Development Economics)

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Declaration

I, Ermias Bassie Yitayew, hereby declare that the thesis entitled **"Demographic Dynamics and Economic Development in Ethiopia",** submitted by me to the award of the degree of Master of Science in Economics at Addis Ababa University, is my own original work and it hasn't been presented for the award of any other Degree, Diploma, Fellowship of any other university or institution.

The interpretation put forth are based on my reading and understanding of the original texts and they are not published anywhere in the form of books, articles and reports. The other books, articles and others, which I have used are acknowledged and properly cited at the respective place in the study.

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This is to certify that the thesis prepared by Ermias Bassie Yitayew, entitled: **"Demographic Dynamics and Economic Development in Ethiopia"** and submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics (Development Economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Acronym

AIC=Akaike information criterion

BR=Birth Rate

CSA= Central Statistical Agency

CPR= Contraceptive Prevalence Rate

DR= Death Rate

DCs = Developed Countries

ECM=Error Correction Mechanism

FDRE=Federal Democratic Republic of Ethiopia

GDP= Gross Domestic Product

HDI=Human Development Index

IMF=International Monetary Fund

IUSSP= International Union for the Scientific Study of Population

LDCs= Less Developed Countries

RGDPPC = Real GDP per capita

TFR=Total fertility rate

UN=United Nations

UNFPA =United Nations Population Fund

VECM=vector error correction model

WB= World Bank

WEOD =World Economic Outlook Database

Abstract

The study is based on a time series data covering a time period of 1990 to 2019 and analyzed the relationship between population (with other demographic variables) and economic development (Real GDP per capita is used as a proxy). Considering econometric analysis, the study employed different tests such as unit root, co-integration, and Granger causality tests and vector error correction model.

According to the estimation result, population Granger causes real GDP per capita i.e. only unidirectional causality which runs from population growth to economic development. Here working age population and young population granger causes real GDP per capita but not vice versa. But real GDP per capita didn't cause them. On the other hand, real GDP per capita causes life expectancy at birth and aged population but not vice versa.

In the long run population growth, working age population (WAPO) has positive and significant effect on economic development while young population group (CHPO), aged group (AGPO) has a negative and significant effect on economic development.

As the finding above shows Ethiopia is under stage two of demographic transition which is characterized by lower death rate but higher birth rate. This shows the need to revise population policy and decrease fertility rate by using different family planning technics and contraceptive methods. So in line with decreasing fertility rate creating human capital development is a key for countries economic development. so greater attention must be given to this since Ethiopia has a promising segment of young population once very trained, educated and experienced its economy will expand.

In addition to this improving the social and economic status of women is a key for a decrease in fertility rate. The development of old-age and other social security systems outside the extended family network can also be a solution to lessen the economic dependence of parents, especially women, on their offspring since the study indicated that aged population affects economic development significantly and negatively.

Keywords: Economic Development, Real GDP per capita, Population Growth, Fertility Rate, Vector Error Correction Model

1. CHAPTER 1: INTRODUCTION

1.1 Background of the study

The debate on the relationship between population growth and economic development has a long history. The impact of population growth on economic growth has been under discussion following the seminal work of Malthus in 1798. So many economists argue about population and its impact on countries economy whether it has positive or negative impact. For instance economists such as, Coale and Hoover (1958) argue that population growth diverts resources from savings and capital accumulation to current consumption of goods and services. Similarly, Hammer (1986) and Kelley (1988) suggest that population growth redirects resources from education and health services to current consumption.

According to Malthusian theory population has a universal tendency to grow at a geometric rate doubling every 30 to 40 years unless checked by dwindling food supplies whereas because of diminishing returns to the fixed factors food supplies could expand only at a roughly arithmetic rate. Thus Malthus ignores the enormous impact of technological progress in offsetting the growth-inhibiting forces of rapid population increases. This means countries can escape from problem of population trap if rapid and continuing technological progress is employed and it can be leads to an increase income.

On the other hand Bloom and Freeman (1998) differ with Malthusian theory noting that food problem is more of a problem of poverty and inadequate income than a matter of high population growth. Thus population and food problem can be solved when income is enough to buy adequate food as prices provide adequate incentives to produce. On the other hand, developing economies would have to export more, receive foreign aid or borrow from overseas to meet their increased demand for food by increased imports. A high rate of population growth not only has an adverse impact on improvement in food supplies, but also it has an effect on the economy by depressing savings, foreign exchange, and human resources.

Rapid population growth tends to depress savings per capita and retards growth of physical capital per worker. The need for social infrastructure is also broadened and public expenditures must be absorbed in providing the need for a larger population rather than in providing directly productive assets. Population pressure is likely to intensify the foreign exchange constraints by placing more pressure on the balance of payment. The need to import food will require the development of new industries for export expansion and/or import substitution. The rapid increase in school-age population and the expanding number of labor force entrants puts ever-greater pressure on educational and training facilities and retards improvement in the quality of education, which is a problem in developing economies. Also, too dense a population aggravates the problem of improving the health of the population and intensifies pressure on employment and the amount of investment available per labor market entrant (Martin 2009).

In general population growth has a substantial impact on any country's economy. For example, it is real that due to the declining population growth many developed countries face a serious problem of dependent ageing society and experience labor shortage which puts a strain on their pension systems. The dependency burden between developed countries (DCs) and least developed countries (LDCs) here is different in case of aged dependent population. This is mainly because of the variation of life expectancy. DCs has relatively higher life expectancy than LDCs because they have good level of living with high per capita income(better standard of living) and better health, sanitation and educational system while LDCs have low level of living, low per capita income, poor health and educational systems. So aged dependency rate in LDC is relatively smaller and has lower impact on the economy in relative to DCs Case.

On the other hand, many developing nations experience a rapid population growth with higher youth dependency rate problem which highly affects their economic performance. The importance of the relationship between population growth and economic development has been recognized by many development economists. As Dawson and Tiffin (1998) put it: "The relationship between population growth and economic development has long been thought to be fundamental to our understanding of less developed countries (LDCs). This is because to show whether population growth stimulates or retards economic growth and the standard of living of these countries which are known by their higher population growth.

Economists advocating the positive side to population growth, say that the population growth creates problems in the short run that include poverty, famine and unemployment. Yet, they also state that in the long run, it leads to new developments through advancement in technology that leave countries better off than if the short run problems never occurred. On the positive side, there is a chain reaction of events caused by population growth. According to the neo-classical growth model, population is beneficial to an economy due to the fact that population growth is correlated to technological advancement. Rising population promotes the need for some sort of technological change in order to meet the rising demands for certain goods and services. With the increased population, economies are blessed with a large labor force, making it cheaper as well, due to its immense availability. An increase in labor availability and a low cost for labor results in a huge rise in employment as businesses are more inclined to the cheap labor. Low labor costs results in a shift of money usage from wages into advancement through technology (Coale and Hoover, 1958).

More people may mean a country can produce and consume more goods and services, leading to economic growth. But this can only occur when employment opportunities grow at least as fast as the labor force and when people have access to the necessary education and training. A larger population may help overcome possibly diminishing returns to this generation's human capital in the production of the next generation's human capital because greater population growth induces more specialization and a larger market that raise returns to human capital and knowledge. If human capital per capita were sufficiently large, the economy would move to steady state growth, whereby in the steady-state growth path, consumption per capita would increase at a slower rate than human capital if the population is growing and if the production of consumer goods has diminishing returns to population. However, consumption per capita can still be increasing, despite these diminishing returns, if the positive impact of the growth in human capital on productivity in the consumption sector more than offsets the negative impact of population growth. Thus, zero population growth is not necessary for sustainable growth in per capita consumption, even with diminishing returns to population in the production of consumer goods (Gerald and Meier, 1995).

In those developing countries where the relationship between population growth and economic performance could be described as positive, the demographic trends stimulate

economic development and promote a rise in living standards. This is because the population growth encourages competition in business activities and, as the country's population grows, the size of its potential market expands as well. The expansion of the market, in its turn, encourages entrepreneurs to set up new businesses. A prominent population economist, Julian Simon, stressed the positive side of population growth and distinguished human beings as the vital and most essential element for economic development. As Simon (1996, 589) put it: "The ultimate resource is people – skilled, spirited, and hopeful people who will exert their wills and imaginations for their own benefit, and inevitably they will benefit not only themselves but the rest of us as well". This is to show that skilled individuals are highly productive and vital for economic development.

1.2 Statement of the problem

According to UN estimates of 2020 Ethiopia's current population is about 115 million and is expected to surpass 200 million by the end of 2049. Ethiopia's population is growing about 2.7% annually with no projected peak year or period of decline. The birth rate in Ethiopia is 36 births per 1,000 people. The fertility rate is 4.1 births per woman. The median age in Ethiopia is approximately 17.9 years of age. 60% of the population in Ethiopia is under the age of 25. Only 49% of the population over 15 years of age is literate and many children only attend school for 8 or 9 years. This implies that almost half and above population of Ethiopia is under the age of 25 since there his high youth dependency ratio as many developing nations face it and this requires quality educational system which is limited in LDC.

This rapid increase in school-age population and the expanding number of labor force entrants puts greater pressure on educational and employment creation and retards improvement in the quality of education, which is a problem in developing economies which is beyond the carrying capacity of their economies. This disproportionality has hindered the economy's ability to grow and develop at a more rapid pace due to the increased need for more resources. Ethiopia remains one of the poorest countries in the world due to its rapid population upsurge.

As Ethiopia performance monitoring and evaluation services (EPMES) assessed on Ethiopian development trends young, rapidly growing populations can be both a boon and a challenge for countries like Ethiopia. A young, healthy, and productive population could help power

Ethiopia's growth over the coming decades. But, the existence of large youth dominance can also be a source of political and social instability if not properly managed. Harnessing the benefits of an expanding, maturing population requires greater service delivery to ensure that these additional people have access to new opportunities for economic growth. In the absence of inclusive growth, large young populations entering working age without jobs or economic opportunity can be a significant driver of social unrest.

Most of Ethiopian policies are highly economic policy and it gives less attention to Population policies and this leads to limited data on Ethiopian population. For instance we know the last Population and Housing Census were conducted in 2007. Although several works have made regarding relationship of population growth and economic change of the country; I can clearly observe two limitations in terms of timing and updating information. For instance, there are demographic changes and new recording economic growth in the country. Thus this study aims to fill what consequences have happened up to now.

Compared to the magnitude of population problem, in Ethiopia, there were few researches specifically addressing population change, dynamics and consequences. The few studies conducted dealt with mainly the impact of population growth on the environment, as a cause to land fragmentation and change in livelihood strategies. However there are several attempts made to show the major impacts of population growth on economic development most of them simply shows the causal relationship between economic growth and population growth by giving little attention for relevant demographic variables. But this study tries to use Real GDP per capita which is a better proxy measure for economic development since it is a good indicator of standard of living instead of economic growth measured by Real GDP alone. This study also examines economic development and demographic dynamism by disintegrating population variables in to different demographic dividends such as: population growth rate, age composition, life expectancy, population density, migration level etc.

For instance Lachisa and Yirdaw (2013) investigated only the causal relationship between population and economic development using vector error correction model (VECM). They found that population Granger causes real GDP in the long run; there is no Granger causality from real GDP to population. Alemu (2014) also find that population growth has had a significant negative

impact in the short run but a positive impact in the long run on the economic performance of the country. Given continued divergence of opinions regarding the consequences of population growth on economic development, this study tried to contribute more regarding demographic variables which were given less attentions in most studies (population size, growth, age structure, life expectancy and other demographic elements and their impact in economic development of Ethiopia.

This study chooses Ethiopia as a case study to empirically examine a long-run relationship between population growth and economic growth by employing time series method of econometric analysis using VECM approach. Specifically, it evaluates the direction and strength of the link between the growth of population and its components on one side and GDP per capita on the other. The study covered a time period from 1990s to 2019.

1.3 Research Questions

The main research questions that this paper tried to address are:

i. Is there is a long-run relationship between Ethiopia's demographic structure and her economic development?
ii. Which age structure has the most significant impact on economic development in Ethiopia?
iii. In which stages of demographic transition does Ethiopia found and what is its implication?

1.4 Objectives of the study

The general objective of this study is to assess economic performance of Ethiopia and its demographic situation using time series analysis. The study will have the following specific objectives

i. To show the causal relationship between demographic variables and Economic Development in Ethiopia.
ii. To assess the impact of demographic variables on economic development.

1.5 Significance of the study

This study has the following significances

i. This study analyzed the impact of demographic variables on economic development and tried to add important contribution to the existing theory.
ii. This study also suggests policy directions regarding population growth and economic development in Ethiopia.
iii. At the end this study can provide useful information to those private and public agencies that are in charge of designing projects and programs that are related with demographic survey.

1.6 Scope and Limitation of the study

Given the big scope on the topic of demographic dynamics and economic development the study is only limited to selected demographic variables and economic growth as a proxy of economic development in Ethiopia. This study is also limited both in time and finance.

1.7 Organization of the study

This paper is structured as follows: chapter one provides an introduction, chapter two describes the existing literature. The subsequent chapters are intended to deal with methodological issues in chapter three; empirical findings and discussions in chapter four and finally, the main findings of the study is summarized in a concluding section of chapter five.

2. CHAPTER 2: LITERATURE REVIEW

2.1 . **Theoretical Review**

The close link between economic development and economic growth is simultaneously a matter of importance as well as a source of considerable confusion. The idea behind measuring aggregate output of the country in terms of GDP is to show the total economic activity of the country. GDP measures the market value of final goods and services produced by a country in a given year (Mankiw, 2010).

On the other hand, economic development is any effect or undertaking which aids in the growth of the economy. That is, it is the "process" of developing and maintaining "suitable economic, social and political environment" in which "balanced growth" may be realized increasing the wealth of the community. Economic development refers to the multidimensional process of reorganization and reorientation of the entire economic system for improving living standard. It is something beyond economic growth. Economic growth indicates the change in the quantities of goods and services. But economic development shows the change in quantity of output and at the same time change in the living standard. Economic growth is one component of economic development. The major indictors of economic development include increase in productivity, decline in social inequality, change in attitude and institution and increase in modern knowledge. However, using the aforementioned measures of economic developments is difficult to capture, it is possible to choose measuring real economic output and per capital income are proxies for economic development as indicated by Todaro and Smith (2012).

The best-known theory linking population growth and economic growth is Malthusian theory. The famous theory that agricultural production progresses arithmetically, while population increases geometrically-is familiar to most social scientists. This theory has convinced many students of economic development, demographers, and policy analysts that rapid population growth retards economic development by tightening job markets, breeding underemployment, and hindering labor force mobility across economic sectors (Coale 1986).This is because of the difficulty of creating employment opportunity, fulfilling quality education and health system and food supplies for the rapidly growing population.

2.1.1. The Malthusian Population Trap

Malthus postulated a universal tendency for the population of a country, unless checked by positive checks (starvation, disease, wars, dwindling food supplies, catastrophes, etc.) to grow at a geometric rate, doubling every 30 to 40 years. At the same time, because of diminishing returns to the fixed factor, land, food supplies could expand only at a roughly arithmetic rate. Modern Economists have called it the low-level equilibrium population traps or, more simply, the Malthusian population traps. Diagrammatically, the basic Malthusian model can be illustrated by comparing the shape and position of curves representing population growth rates and aggregate income growth rates.

Per capita income growth is the difference between income growth and population growth—hence the vertical difference between these two curves. In the Harrod-Domar (or AK) model, whenever the rate of total income growth is greater than the rate of population growth, income per capita is rising; this corresponds to moving to the right along the x-axis. Conversely, whenever the rate of total income growth is less than the rate of population growth, income per capita is falling, moving to the left along the x-axis. When these rates are equal, income per capita is unchanging (Todaro and Smith 2012).

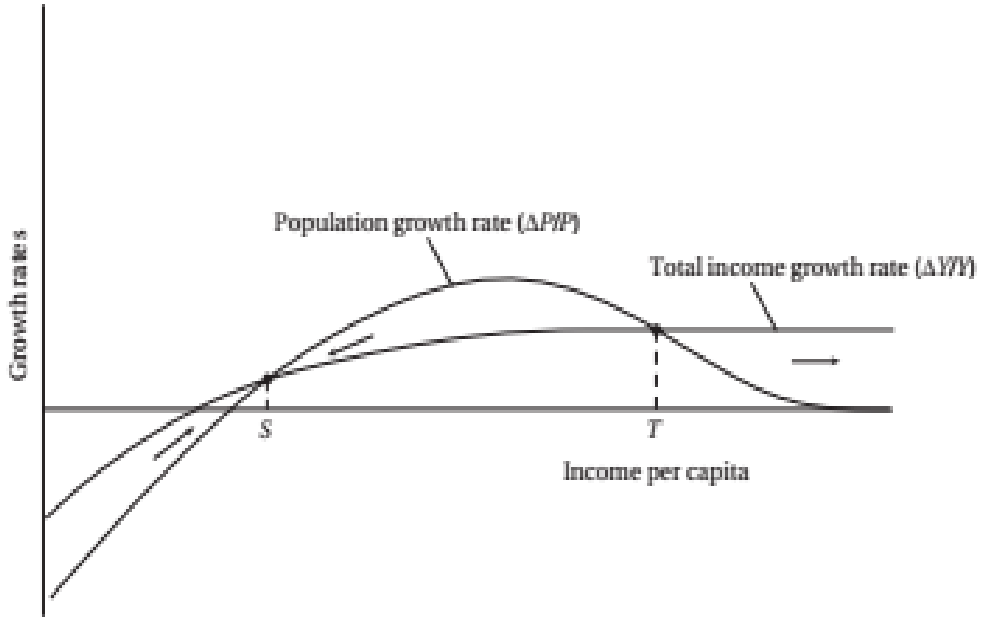


Figure 1. The Malthusian population traps (Todaro and Smith 2012, 282)

According to modern-day neo-Malthusians, poor nations will never be able to raise much above their subsistence levels of per capita income unless they initiate preventive checks (birth control) on their population growth. So here Malthusian population trap is criticized based on the following two main grounds.

First**,** the model ignores the enormous impact of technological progress in offsetting the growth-inhibiting forces of rapid population increases. Countries can escape from problem of population trap if rapid and continuing technological progress is employed and it can be represented by an upward shift of the income growth.

The second basic criticism of the trap focuses on its assumption that national rates of population increase are directly (positively) related to the level of national per capita income. According to this assumption, at relatively low levels of per capita income, we should expect to find population growth rates increasing with increasing per capita income. As a result of modern medicine and public health programs, death rates have fallen rapidly and have become less dependent on the level of per capita income. Moreover, birth rates seem to show no rigid relationship with per capita income levels. (Todaro and Smith 2012).

On the contrary to Malthusian theory Ester Boserup (1965) basically argued that population would never out strip food supply technology will continue to improve and keep up with demand. She argues that population growth will give to the society an opportunity to invent new technology in the intensification of agriculture with socioeconomic change that results in improving soil fertility . She considers population growth as autonomous force of exogenous factor that causes to technological progress in agriculture and postulates that aggregate agricultural production function in the long run will always shift upwards in response to population pressure to maintain output per capita though there may be diminishing return to the agricultural labor in the short run. Thus for her, the primitive agricultural communities are subject to continuing change in agricultural technology. She encourages Short fallow cultivation, bush fallow cultivation, annual cropping multi cropping etc.

2.1.2. **The Demographic Transition**

The process by which fertility rates eventually decline to replacement levels has been portrayed by a famous concept in economic demography called the demographic transition. The demographic transition attempts to explain why all contemporary developed nations have more or less passed through the same three stages of modern population history.

Before their economic modernization, these countries for centuries had stable or very slow-growing populations as a result of a combination of high birth rates and almost equally high death rates. This was stage 1. Stage 2 began when modernization, associated with better public health methods, healthier diets, higher incomes, and other improvements, led to a marked reduction in mortality that gradually raised life expectancy from under 40 years to over 60 years. However, the decline in death rates was not immediately accompanied by a decline in fertility.

As a result, the growing divergence between high birth rates and falling death rates led to sharp increases in population growth compared to past centuries. Stage 2 thus marks the beginning of the demographic transition (the transition from stable or slow-growing populations first to rapidly increasing numbers and then to declining rates). Finally, stage 3 was entered when the forces and influences of modernization and development caused the beginning of a decline in fertility; eventually, falling birth rates converged with lower death rates, leaving little or no population growth (Todaro and Smith 2012). The figure below depicts the three historical stages of the demographic transition in Western Europe.

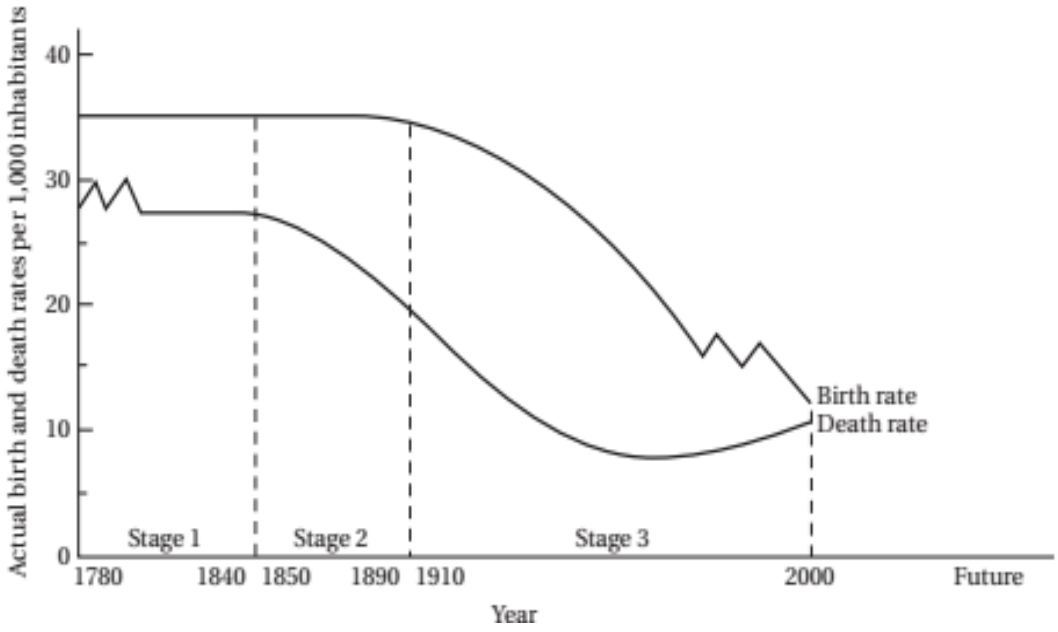


Figure 2 Historical stages of the demographic transition in Western Europe (Todaro and Smith 2012, 279)

Stage 1: before their economic modernization countries had stable or very slow-growing populations because of high birth rates & almost equally high death rates Stage 2: when modernization starts better public health methods, healthier diets, higher incomes, and other improvements, leads to reduction in mortality that gradually raised life expectancy. However, the decline in death rates was not followed by a decline in fertility. As a result, the growing divergence between high birth rates and falling death rates led to sharp increases in population growth compared to past centuries. This stage thus marks the beginning of the demographic transition (the transition from stable or slow-growing populations first to rapidly increasing numbers and then to declining rates). Stage 3: this stage was entered when the forces and influences of modernization and development caused the beginning of a decline in fertility; eventually, falling birth rates converged with lower death rates, leaving little or no population growth.

2.1.3. The Demand for Children in Developing Countries

Children in poor societies are seen partly as economic investment goods in that there is an expected return in the form of both child labour and the provision of financial support for parents in old age. Families in LDC consider children as investment because they consider and think about the benefit for the source of income when they become older. It's common that most of developing countries are more or less agrarian and this countries are characterized by low level of living, higher illiteracy, low health access, low education access, low family planning, religions and traditions and others leads to a higher fertility in these countries since they consider children as an asset (Todaro and Smith 2012).

Tradition, culture and religions have their own role on higher population growth of least developing countries since they are against modern birth control mechanisms such as contraceptive and other biological methods. For instance, Sundararajan et al. (2019) identified that many studies have demonstrated the complex and variable relationship between religious faith and beliefs about family planning in sub-Saharan Africa. In case of Tanzania they founded that a major reason for poor acceptance of family planning and other modern birth control methods is that women and their partners are uncertain about whether pregnancy prevention is compatible with their religious beliefs. This is also true that religion plays its own role in higher fertility in Ethiopia. Here families believe that using modern birth control methods and contraceptives are assumed as a sin and they consider these as if it is against their religious teachings especially in the rural community.

The other instrument commonly used to identify the consequences of fertility on the welfare of families relies on the sex composition of births, and has serious drawbacks. This variable may significantly affect parents' decisions on whether to have further children, and it may be assumed to be approximately independent of parent preferences or family constraints if there is no sex-selective abortion or infanticide. But this variable may not satisfy the criteria for a valid instrument, because the social and economic consequences of a child's sex involve many culturally distinct costs and benefits for his or her parents, such as the provision of dowries for daughters in some parts of the world. Thus, the sex composition of early births is likely to involve lifetime wealth effects for parents, in addition to affecting fertility, giving rise to many changes in family time allocation, expenditure patterns, and life-cycle savings (Rose, 2000).

According to United Nations Population Fund (UNFPA) (2011) estimates the LDCs have the largest and most rapidly growing youth population which is mainly because of their high fertility and high population growth. Today about 60% of the population in LDCs is under the age of 25. The group of young people between 10 and 24 years continues to grow rapidly in the LDCs. However, in the LDCs the number will continue rising and there is not a maximum figure before 2050. The estimate also suggests that the number of young people in these countries will increase by more than 60 per cent between 2010 and 2050. A large and growing share of young population can support the economic and social development of countries, but can also cause considerable challenges, where countries do not have the capacity to ensure adequate investment, especially in their health and education, and where economies do not generate sufficient productive and remunerative employment for young people.

But here in case of some developed countries the government prepares pronatalist population policies and some initiatives to have children for parents. This is mainly because of their population composition is mainly senior and aged which leads higher aged dependency rate since their fertility rate is very low. So they prepare initiatives for having enough babies to keep their population steady. Examples of such countries includes: Germany, Turkey, Japan, Russia, Taiwan etc.

2.1.4. Ethiopian Demographic Review

Despite its long history of humankind in Ethiopia, there were no estimates of human population prior to the 1930s except few evidences. The growth rate of population was slow until 1970 and step up thereafter. In the beginning of 1900s, Ethiopia had five million people that have increased by twenty times within one century. The first and the second population and housing census were conducted in 1984 and 1994 with equivalent population size of 42.6 and 53.5 million. Nevertheless, the annual growth rate of population has declined from 3.3% in 1984 to 2.9% and 2.6% in 1994 and 2007. The growth rate of population is estimated to be 2.3%. Currently, Ethiopia is the second population giant among ten countries in Africa that account 61% of the total population of the continent. Nigeria and Ethiopia contribute 15.3% and 8.3% of the total population in Africa, respectively (Mekuria 2018).

The temporal dimension of population changes in terms of size and structure, and spatial distribution of population due to births, deaths, migration, and settlement patterns refers to demographic change. Since 1970, child and adult mortalities have declining trends for three decades. Considerable change is observed for maternal mortality from 1250 in 1990 to 353 for every 100, 000 live births in 2015. More than 70% Ethiopian population is under 30 years of age while close to 50% are under the age of 15. A women's fertility rate has declined steadily from 7.4 children in 1980s1 to 5.9, 5.4, 4.8, 4.1 children in corresponding years of 2000, 2005, 2011 and 2014. The fertility rate is expected to decline by 3.11 and 1.99 in the 2020s and 2060s, respectively. Reductions in fertility, child mortality, crude birth and death rates have accelerated the transition and demographic dividend (Mekuria 2018).

The net reproduction rate of surviving a daughter per women has declined from 2.3 in the 1980s to 2.0 in the 2010. Infant mortality rate has declined from 140 children in the 1980s to 50 children per 1000 in the 2010s. Child mortality is likely to decline from 32 in the 2020s to 15 children in the 2060s, respectively. Females have higher life expectancy (65 years) at birth than males (61.3 years) in the 2010s. All these changes, particularly population's age opens up a window of opportunity to Ethiopia that capture the demographic dividend given that favourable socio-demographic and economic policies and conditions exist. Population growth is accelerating whereas the birth and mortality rates are decelerating (Mekuria 2018).

2.2. Empirical Review

In this section different empirical literatures has been included which are founded by many researchers with different findings regarding the relationship between demographic dynamism including population growth with economic development. Even though the relationship between population growth and economic development has been studied by different researchers some of selected evidences are included here which goes in line with our specific title. For example, Bucci and La Torre (2007) used a two-sector endogenous growth model. They pointed out that population growth may have a negative or ambiguous effect on a country's economic development. In other words, when physical capital and human capital are substitute, the population growth has a negative impact on the economic development. On the other hand, when physical capital and human capital are complementary, the effect of population growth becomes

ambiguous. Mankiw et al. (1992) has also found that by including the role of human capital (in line with the endogenous growth theories) population growth negatively affects growth in GDP per capita.

In their study on the Chinese economy, Gao and Shao (2016) analyzed the impact of demographic structure in China provinces on economic growth. The result supports the demographic dividend hypothesis. The findings of Zhang (2014) also support the demographic dividend hypothesis and revealed that the evolution of age structure accounts for about one-fifth of GDP per capita growth where a change in the internal demographic composition of the labor force accounts for over 50 percent. It was also found that the dynamics of age structure across provinces accounts for over one-eighth of the persistent inter-provincial income inequality.

Similarly, by incorporating age structure dynamics into the growth equation and applying it to China‘s provincial-level data, Wei and Hao (2010) examined the economic implications of demographic change in China. They found that demographic structure changes, specifically a decline in fertility rate, have helped fuel the growth of the Chinese economy. The channel through which demographic change affects income growth is primarily through its impact on steady state income levels and it is more evident in provinces where market forces operate. The result also showed a significant feedback effect between demographic behaviors (birth rates, life expectancy and marriage age) and economic growth.

Furthermore, Agrawal et al. (2015) examined the impact of changing population age structure on performance of the Chinese and Indian economy. They found that unlike China, the slow pace of decline in birth rate had adverse effects on India's savings and growth potential, together with the magnitude and timing of her first demographic dividend. They further argued that high domestic savings and investments in the demographic dividend phase are crucial in neutralizing the adverse effects of population ageing and to foster sustainable growth. Also, Bloom et al. (2007) studied that increases in the proportion of the working age population can yield a demographic dividend that enhances the rate of economic growth.

Song (2013) found a negative influence of young population growth on economic growth of Asian economy but supports the demographic dividend hypothesis. This suggests that the favorable demographic structure accounts for the rapid growth of the Asian economies. Their result indicates that negative effects of growth in the total population and the young population on economic growth while showing positive effects of growth in the working-age population and the working-age population ratio. Mason and Lee (2008) remarked that longer life, lower fertility, and population aging all raise the demand for wealth to provide for old age consumption in East Asian countries.

Coale and Hoover (1958) elaborated a theory stressing family economics and capital formation. According to this theory, rapid population growth forces families to consume what otherwise would be savings, adversely affecting national saving rates and thus capital formation and investment rates as well. Moreover, high youth dependency ratios force nations to invest scarce capital in a game of "catch-up" as they attempt to provide education, infrastructure, and jobs for burgeoning populations (Simmons 1988:129-31). Allocating capital to nonproductive segments of the population (e.g., educational expenditures) forces a nation to undercapitalize its existing labor force (Bloom and Freeman 1988).

In fact, people are producers as well as consumers of wealth, roles that are influenced by the life course. While growth in the number of children may retard economic production as the population invests scarce capital in goods and services that yield few immediate economic multipliers, growth in the economically active population should cause no such problem. In fact, some evidence suggests that population growth can have a short-term negative effect on economic growth because of youth dependency, but has a long-term positive effect resulting from labor force growth and a subsequent boost in aggregate demand (Bloom and Freeman 1988; Barlow 1994).

Neoclassical economic theorists consider growth in the labor force a requisite for economic growth (Todaro 1989:116). Common arguments for a positive correlation between economic development and labor force growth revolve around scale effects and demand effects. A growing labor force encourages scale effects in terms of: a larger domestic market, a more complex division of labor, a greater volume of diffused information, technology, and skills and lower per

capita costs associated with public infrastructure (e.g., roads, ports) because of the volume of use (Simon 1981). On the demand side, the Kuznets cycles of U.S. economic history suggests that an increase in population has (until recently) been associated with an increase in economic production. This relationship may be attributable to the increased demand for consumer goods in the wake of family formation (Easterlin 1968).

Wongboonsin and Phiromswad (2017) found that demographic structure affects economic growth differently in developed and developing economies. For developed countries, they found that an increase in the share of middle-aged workers has a positive effect on economic growth through institutions, investment and education channels. On the other hand, an increase in the share of the senior population has a negative effect on their economic growth. In case of developing countries, they found that an increase in the share of younger segment of the population has a negative effect on economic growth through investment, financial market development and trade channels.

Eniang (1977) founded that in case of Nigeria rapid population growth has a disadvantage for an economy for two major reasons. First, it retards capital formation by depressing saving and second, it changes demographic structure such that there is an increase in youth population and the low skilled and unskilled labor in the labor force. Similarly, Brunow and Hirte (2006) examined the relationship between age structure and regional economic growth and found evidence in favor of a strong positive impact of population age structure on real GDP per capita growth where the labor force below 45 years exerts the strongest positive impact. The result also supports the learning effects was found that a region with a relatively high share of individuals between 45 and 74 years have a relatively better performance than the average of its country whereas a high share of the young labor force have no significant impact. Musa (2015) also found that the relationship between population growth and economic growth in India is positive and there exist a unidirectional relation, running from economic growth to population growth.

Humair et al. (2010) examined the prospects for economic growth in Nigeria from a demographic change and human capital perspective. They found that Nigeria has a substantial demographic opportunity on the horizon however, she lacks policy options with which to harness her demographic transition into indefinite sustained growth and unemployment, low job

productivity, and low levels of human capital are highlighted as the major roadblocks to achieving these benefits. Similarly, Tartiyus et al. (2015) evaluated the impact of population growth on economic growth in Nigeria. The result revealed a positive relationship between economic growth and population, fertility and export growth and an inverse relationship between economic growth and life expectancy as well as crude death rate.

As Wako (2012) studied, the causal relationship between demographic factors and economic development in Ethiopia revealed a negative long run relationship between per capita income and population growth and a positive relationship between the former and growth of workers with bidirectional causality in both cases. From our neighbor Kenya Gideon et al.(2013) founded that population growth and economic growths are both positively correlated which means there exists bi-directional causality from population growth to economic growth, and vice versa. They conclude that in Kenya population growth promotes economic growth and subsequently economic development. Here the study result shows the existence of a long-run relationship between population and economic growth in Kenya. On the other hand Ethiopia is one of the most populous countries in Africa next to Nigeria followed by Egypt and Democratic Republic of the Congo. According to World Bank 2017 report adult literacy rate in Ethiopia (% of people ages 15 and above) is nearly 51.77% while Kenya's was 81.5% which is better than Ethiopian case. So that countries population with higher literacy number is more likely to support their economy.

Lachisa and Yirdaw (2013) investigated the causal relationship between population and economic development using vector error correction model (VECM). Their results shows that there exists unidirectional long run causal relationship from economic development to population but, no long run causal relationship exists from population to economic development. The short run causality tests further suggest that population Granger-causes economic development; however, there is no reverse short run causality form economic development to population. Kassahu (2014) also founded that population growth has had a significant negative impact in the short run but a positive impact in the long run on the economic performance of the country. He also suggested that realistic population policies should be designed and implemented to

adjust/control high rate of population growth and make it a beneficial resource for the economy. For instance minimizing high birth rate can be an effective policy instrument since high birth rate can be a burden on the economy.

Most of the studies in the literature above show that negative influence of young population growth on economic growth and it requires higher attention for child care, schooling and health system expenses and aged populations have also similar effects. As we have mentioned earlier almost half and above population of Ethiopia is under young age population category which is unproductive and requires huge investment now since it supports the economy in the long run once properly grown, schooled and trained.

Many theoretical analyses argue that high population growth creates pressures on limited natural resources, reduces private and public capital formation, and diverts additions to capital resources to maintaining rather than increasing the stock of capital per worker. Others point to positive effects such as economies of scale and specialization, the possible incentive to favorable motivation caused by increased dependency, and the more favorable attitudes, capacities, and motivations of younger populations compared with older one.

The interaction between population growth and economic development has been quantitatively studied by different scholars with different respective results; many of these academic investigations have used cross-section regression to analyze the relations between the two variables and some others use time series regressions.

Studies on the relationship between per capita income and population growth that employed cross-section regression analyses are more likely to suffer from the problem of heteroskedasticity. But here in this study most of the data since the end of the 1990s is available and it allows conducting time-series regress on analysis to examine the long-run relationship between population and economic development. The availability of high-quality data sets encourages further research on the topic by using standard econometric tools for time-series data, such as unit roots test, Johansen co integration test (1988), Granger causality test (Granger 1969).

For instance, as mentioned above Dawson and Tiffin (1998), Thornton (2001) used time-series data to analyze a long-run relationship between population growth and economic development in India, Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. Therefore this study has applied the augmented Dickey-Fuller (ADF) unit root test, Johansen co integration test and mainly vector error correction model (VECM) and it investigates the causal relationship between population and economic development.

3. CHAPTER 3: MATERIALS AND RESEARCH METHODS

3.1. Types and sources of data

This study has used secondary data on population and the per capita real Gross Domestic Product (GDP) comprising of time series observations over the period 1990,s to 2019. The data employed here in this study is collected from a variety of sources such as IMF (2017), World Economic Outlook Database (WEOD 2019), United Nations World Population Prospects (UNWPP 2017) and others.

3.2. Model specification

As indicated by Todaro and Smith (2012), real GDP per capita income is good proxy measure or indicator for economic development. So that this study has used real GDP per capita income is used to proxy for economic development.

Real gross domestic product (GDP) per capita is currently the best indicator of national wealth with regard to its standardization in constant international dollar, its adjustment for the actual purchasing power of national currencies. GDP per capita is gross domestic product divided by midyear population.

Evaluating the cause-effect relationship between population and economic performance lies in establishing a theoretical relation between the two. Using size or growth rate of total population however may ignore the heterogeneity within the population in terms of age (dependents versus independents) and economically active (those who are under the range of working age) among others.

So, separating the effect of population growth into the effects of population (size or growth rate) in various age groups most notably into dependent and working-age populations – emerged. So that the demographic structure (labor) will be disaggregated into: labor force (working age population) which is mostly economically active (15-64 years) and dependent population [children population (0-14years) and the aged population (65 years and above)]. Beyond the age structure demographic structure also includes population density, migration, fertility, mortality

rates, birth rate, death rate, life expectancy at birth etc. Hence, estimations and tests about the relationship between demographic and economic variables involved the following variables:

Based on the foregoing and the theoretical framework employed in different studies, the mathematical model for this study can be presented as follows in two main models the first model contains Real GDP per capita and total population while the second model shows the relationship between RGDPPC and other demographic variables. It is because of population and other demographic variables are highly correlating by their nature so that two models are used in order to see their impacts individually:

The first empirical models to be estimated which is aimed to show causations between the two main variables in the study are.

$$\boldsymbol{lnRGDPPCt = \alpha 0 + \alpha 1\ lnPOGRt + \varepsilon t} \text{ ..... (1)}$$

$$\boldsymbol{lnPOGRt = \beta 0 + \beta 1 lnRGDPPCt + \varepsilon t} \text{ ..... (2)}$$

Where **ln*RGDP*PC** is the logarithm of real GDP per capita, lnPOGR is the logarithm of Population, α's and β's represent parameter estimates, and Ɛt is the error term

The second model shows the relationship between RGDPPC and other demographic variables.

$$\text{lnRGDPPCt} = (\alpha 0 + \alpha 1\text{lnCHPOt} + \text{a2lnWAPOt} + \text{a3lnAGPOt} + \text{a4lnLEXPt} + \text{E})$$

Where:

lnRGDPPC = log of Real GDP per capita (as a measure of economic performance per head income of the whole population)

lnCHPO= log of dependent population [children population (0-14years) or youth population

lnWAPO= log of working age population [population (15-64 years)

lnAGPO = log of dependent population [aged population (65 years and above)
lnLEXP= log of Life Expectancy at birth

And (a0, a1….a4) parameter estimates

E=Error term

Real GDP per capita is measured at constant International Dollars i.e. its adjusted for the actual purchasing power of national currencies and population size, child population or younger population , working age population and aged population are in millions while life expectancy at birth is measured by the number years stayed at birth.

It is expected that population growth and dependent population (aged and young) will have a negative impact on the economy being a developing country while (working age) economically active population and life expectancy will have positive impact on the economy. So that the expected sign for the growth rate of the total population will be negative and the expected sign for working-age population will be positive, as people in that group are more likely to be economically active in the sense that they work and save more than they consume (Bloom and Williamson 1998). One the other hand , both young population and elderly populations are expected to have negative signs since these two age groups are considered dependent population that consumes more than they produce and depends on the output and savings generated by the working-age population (Higgins and Williamson 1997, Bloom and Williamson 1998).

Having our economic models above the study applies both descriptive and econometric analysis. Descriptive analysis tries including tables, charts, and figures to show the trend and characteristics of major demographic elements. While Econometric analysis will use time series secondary data ranging from the year 1990,s-2019, and preliminary tests of stationary such as unit root test will be conducted on each variable in the model. The unit root test would be carried out using Augmented Dickey Fuller (ADF) to determine the level of stationary of the variables and Johansen co integration test to see the relationships between the two variables. The study mainly used vector error correction model (VECM) and investigated the causal relationship between demographic variables including population and economic development. The existence of Cointegration implies the existence of Granger causality at least in one direction (Granger, 1988). Thus if cointegration exists using VECM is an appropriate model to examine long run and short run dynamics in our study.

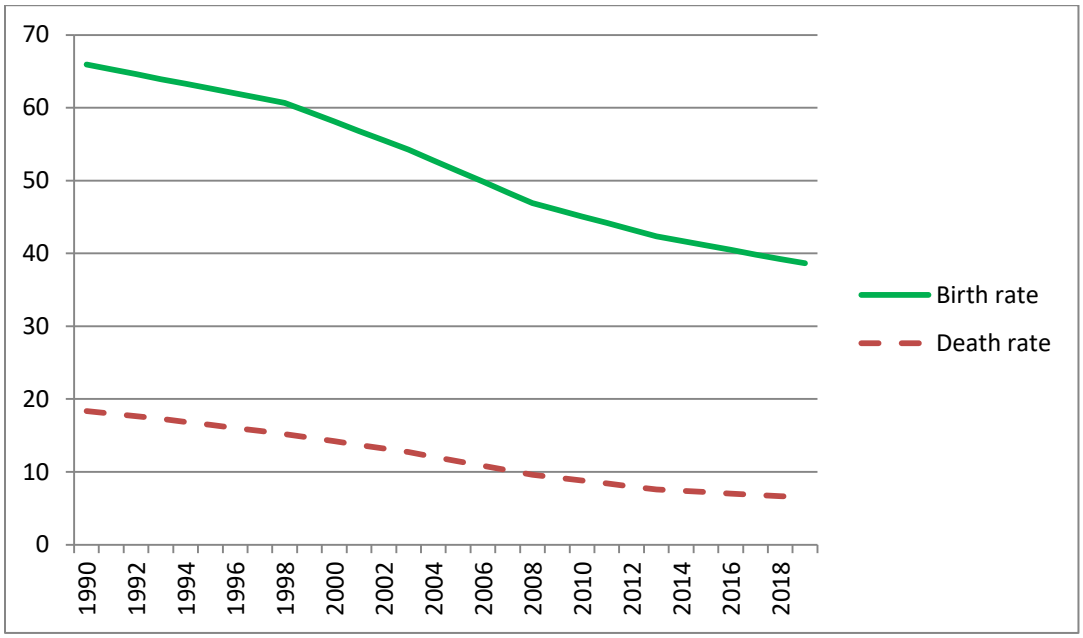
4. CHAPTER 4: DATA ANALYSIS AND DISCUSSIONS

4.1. Results of Descriptive Analysis

4.1.1. Trends of selected demographic variables in Ethiopia

A. Fertility rate, Birth Rates and Death Rates

As we have mentioned in the literature review part about demographic transition when countries economy starts to grow and modernization starts better public health methods, healthier diets, higher incomes, and other improvements leads to reduction in mortality that gradually raised life expectancy. However, in case of Ethiopia the decline in death rates was not immediately followed by a decline in fertility. As a result, the growing divergence between high birth rates and falling death rates led to sharp increases in population growth which is exactly the same as with Ethiopian case as we can see from the graph below. Here we can observe that Ethiopia is at stage two in case of stages of demographic transition since there is a falling death rate but relatively higher birth rate causing a rapid population growth still.



Source: Authors computations based on United Nations - World Population Prospects 2019

Figure 3. Trend of Birth Rate and Death Rate (1990 – 2019)

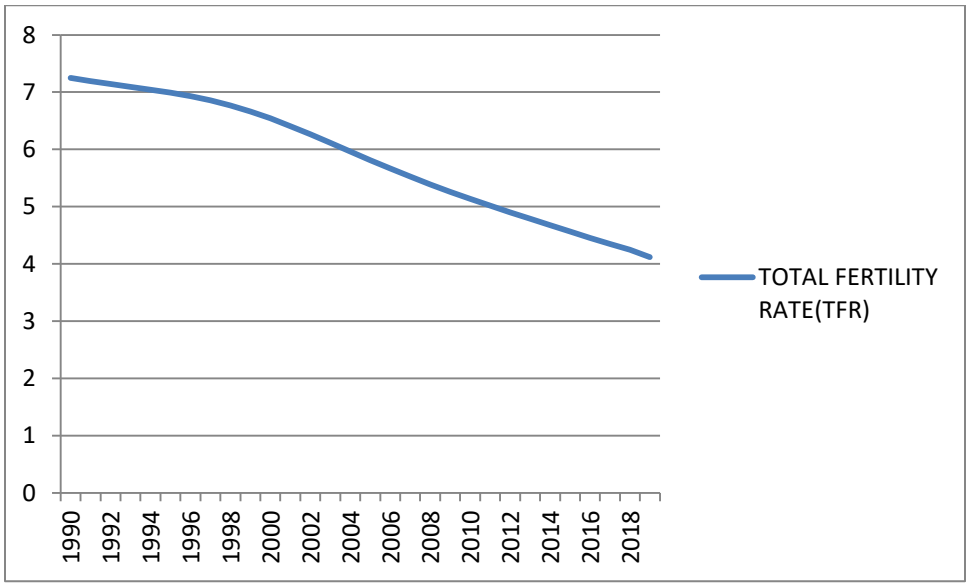
As the trend from the graph indicates even though there was a continuous decrease in death rate from 1990 to 2019, the birth rate tries to decline only since mid of 1990's. The trend depicts significant difference between birth rate and death rate which adds more on the size to the population of the country. This can also be evidenced by the deviation in an average birth rate of around 40.3 and death rate of around 11.9 per 1,000 Population for the time period covered. This significant difference is an implication of alarmingly growing population in the country. In 1990 the total population of Ethiopia was around 47 million and in 2019 it becomes almost around 112 million. This shows that it strictly increases by more than double within this short period time nearly within 30 years

Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year. I.e. Fertility rate means total (births per woman). So as we can observe from our data Ethiopia's fertility rate was very high i.e. 7.2 births per woman in the early 1990s before decreasing to 6.5 in 2000 and 4.12 in 2019. This is because of the introduction of family planning services, improvements in female economic status; educational status etc. plays a greater role in decreasing fertility rate. But population growth continues to increase even after the fall in birth rates because the large existing youthful population expands the population's base of potential parents which is commonly known as the hidden momentum of population growth. It is true that high birth rates cannot be altered substantially overnight and religious, social, economic, and institutional forces that have influenced fertility rates over a long period of time do not simply handled with in a short period of time.

According to FDRE ministry of health 2020 report Ethiopia has shown remarkable progress in reaching women and men with voluntary family planning (FP) services. Thus this brings a decline of maternal mortality ratio by 53% from 871/100,000 in 2000 to 412/100,000 in 2016 per 100,000 live births. Similarly, infant mortality decreased by 50% from (97/1,000 in 2000 to 48/1,000). The Contraceptive Prevalence Rate (CPR) has increased by 37% (8% in 2000 to 41.1% in 2019 whereas, TFR has declined from 5.5 children per woman in 2000, to 4.6 children per woman in 2017.

Despite the significant progress in CPR, there is a huge variation among urban and rural communities, different regions and across socio demographic status. For example, urban women are much more likely than their rural counterparts to use any modern method of contraception (50 percent versus 38 percent).

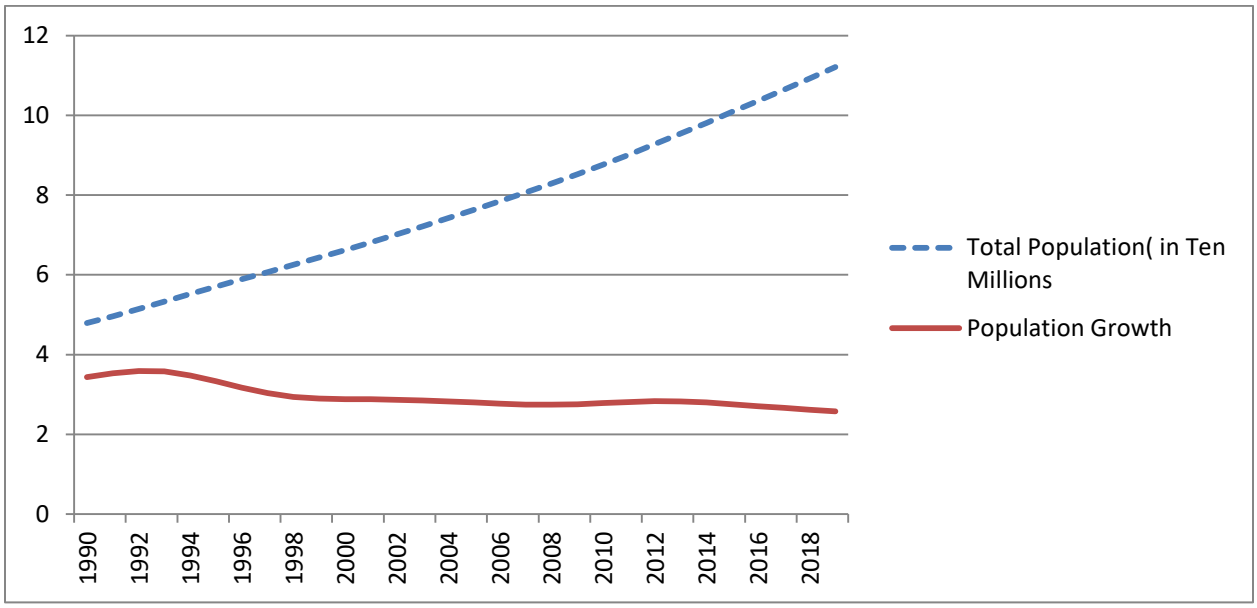
In conclusion, family planning saves the lives of women and children, improves the quality of life for all and reduces morbidity and mortality from pregnancy. Child Health Benefits having too many children places children's health at risk. In developing countries, evidence shows that achieving birth spacing of more than two years between pregnancies could reduce child death by up to a third. On the other hand infant born to a teenage mother is more likely to be born too early and weigh too little at birth and is 24 percent more likely to die in the first month of life than an infant born to a mother aged 25-34 years. Families with fewer, healthier children can devote more resources to providing their children with adequate food, clothing, housing, and educational opportunities. In addition to the benefits listed above family planning programs are very effective in decreasing fertility rates which through time leads to a decrease in the composition of youth age population.



Source; World Population Prospects 2019

Figure 4 Fertility Rate Trends of Ethiopia (1990-2019)

B. Trend and size of Ethiopian population



Source: Constructed based on data from World Development Indicator (2019).

Figure 5. Trend and size of Total Population (1990 – 2019)

As World Development Indicators (2019) data depict, with a total population of around 47 million in 1990, Ethiopia experienced a population explosion which resulted in above 112 million people by 2019. Here, Ethiopian population size doubled itself almost within 24 years i.e. from 1990 and 2013 showing a doubling time of about 24 years. According to UN estimates Ethiopia's current population is nearly about 115 million and is expected to surpass 200 million by the end of 2049.

Even though the Ethiopian total population size was increasing at the beginning, it seemed that the rate at which population size rises has recently stabilized at about 2.5% per annum as per our data source indicates. But here Ethiopian population growth rate declining doesn't mean that Ethiopia has overcame the corresponding impacts of population on its economy but after a time when its population age structure is adjusted she may overcame by some angle given other economic limitations.

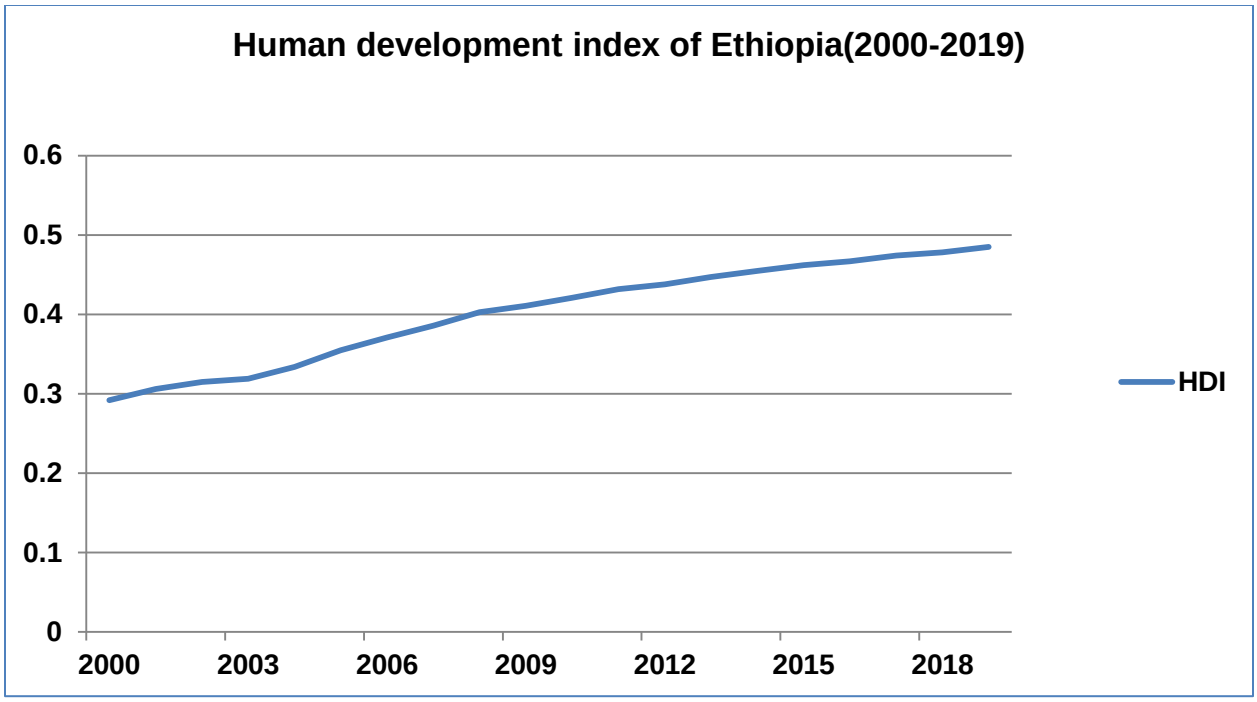
4.1.2. Economic development and Population Growth

a. Population growth and human development index

The effect of population growth on the economic performance of a country or a region is also reflected in changing HDI, which is designed to particularly reflect long-term changes in human development as opposed to short-term fluctuations. The Human Development Index (HDI) is an index that measures key dimensions of human development having three main dimensions which include measures of achievement in education, a long and healthy life as well as decent standard of living which means adjusted real GDP per capita (real GDP divided by midyear population).

The HDI attempts to rank all countries on a scale of 0 (lowest human development) to 1 (highest human development) based on three goals or end products of development: longevity as measured by longer life expectancy at birth, knowledge as measured by a weighted average of adult literacy (two-thirds) and gross school enrollment ratio (one third), and standard of living as measured by real per capita gross domestic product adjusted for the differing purchasing power parity of each country's currency to reflect cost of living and for the assumption of diminishing marginal utility of income. Using these three measures of development countries HDI is ranked into four groups: low human development (0.0 to 0.499), medium human development (0.50 to 0.799), high human development (0.80 to 0.90), and very high human development (0.90 to 1.0) (Todaro and Smith 2012).

So according to the data employed in this study and depicted in the graph below Ethiopia is grouped to the first group indicating that Ethiopia is still under low human development (0.0 to 0.499) category.



Source: United Nations Statistics Division (2020) and World Bank (2020).

Figure 6. Ethiopia human development index

Thus Human Development Index (HDI) is an index measuring national socioeconomic development, based on combining measures of education, health, and adjusted real income per capita or decent standard of living

b. Population growth and Economic growth

Here this section assesses the consequence of persistent increase of population growth in Ethiopia on Ethiopian Economy. Population growth is a debating issue that many researchers advocate its benefit and others preaches its negative impact on countries economy. Todaro and Smith (2003) indicated that the debate over the seriousness of the consequences of rapid population growth is not yet solved. So this study tried to evaluate the effect demographic variables in general and population growth in particular on Ethiopian economic development. Before we are going to see the econometric results let see the descriptive part concerning population growth and RGDPPC which is obtained from RGDP using the midyear population

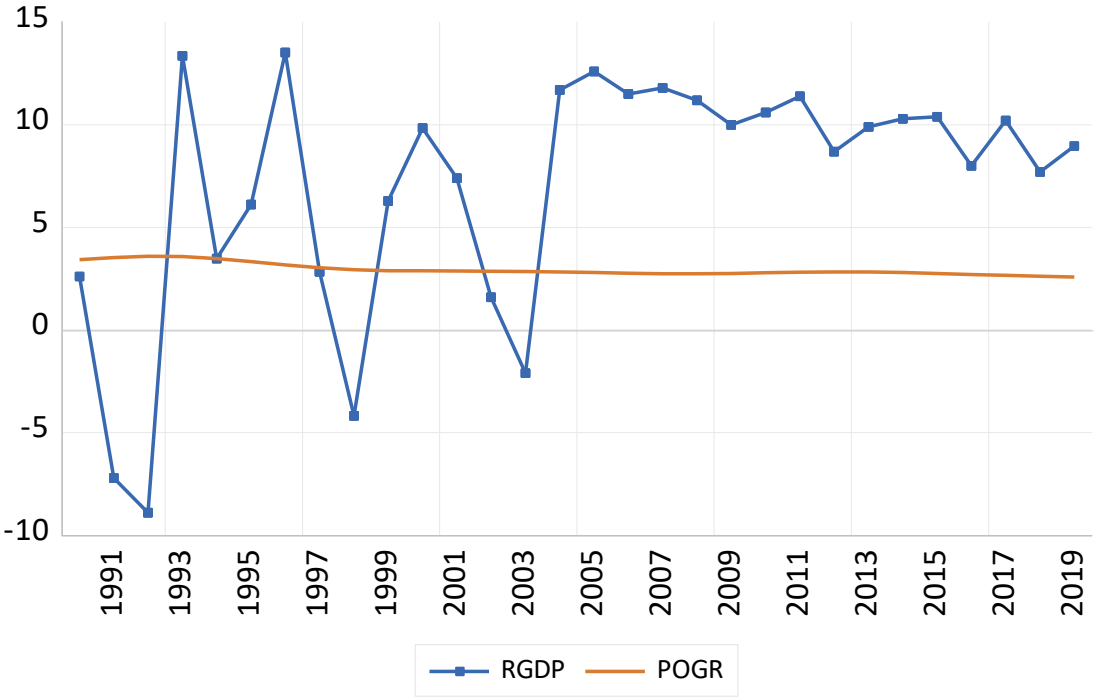
through trend graphs. As we have mentioned in the model above real GDP per capita is a good proxy measure for economic development and better indicator of welfare and standard of living.

As we can see from our graph below there exists almost a constant population growth rate with a nearly constant trend since the mid-1990, s to 2014. After 2015 there exist a relatively slighter decrease in population growth rate but almost persistent. On the contrary real GDP growth rate doesn't show nearly constant growth rates as population growth did. Thus Ethiopia's real GDP shows up and down trends with higher fluctuations. Several factors can be mentioned for these fluctuations in a specified period. In the beginning of 1990,s following the fall of the Dergue regime a transitional government called EPRDF (Ethiopian people democratic revolutionary democratic front) was established. During the last era of the military regime Ethiopia was almost unstable and it was under higher political tensions in all directions in which both internal and external parties were a threat which highly retards the economy. Due to all this transitional and pre transitional periods Ethiopian economy was highly affected and its Real GDP growth rate was very low even negative in the beginning of 1990,s.

But after 1995 EPRDF government tried to establish a federal constitutional framework in order to resolve political and economic tensions in Ethiopia. And the then government of Ethiopia EPRDF tried to transform Ethiopian economy by adopting new Economic Policy and structural changes in the economy which mainly aimed to reduce the public sector dominance in critical sectors of the economy and creating conditions by which market forces determine the supply and demand of goods and services and promote private sector participation in the production and distribution of such goods and services. In addition to these attentions was given in boosting the agricultural output taking into account the predominance of small holder farmers at that time and the predominant agrarian structure of the country.

So at these periods Ethiopian economy starts to recover and revive until it starts to decline sharply following the Ethio-Eritrean war by border conflict which takes place for about two years since 1998 to 2000. It is again followed by another crises during Ethiopian parliamentary elections of May 2005 and its aftermath also have its own impact on Ethiopian economy as well it was leading to higher political instability and economic stagnation as we can see from our graph. But starting from 2005 Ethiopian economy has started to grow by 7% at minimum and

12% percent maximum. All the trends of Population growth, real GDP growth and Real GDP per capita are depicted as follows below.

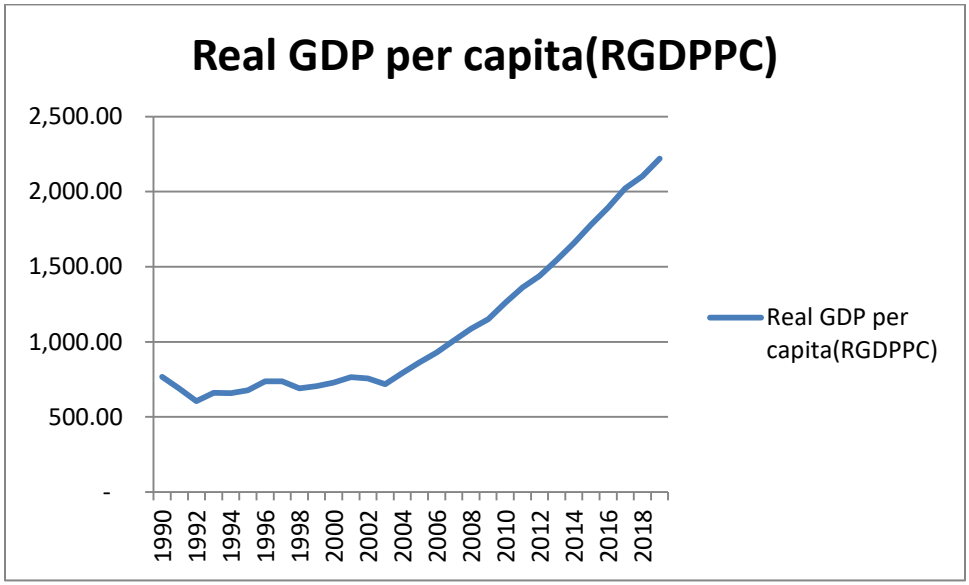


Source: IMF and United Nations - World Population Prospects 2019

Figure 7. Trends of population growth and Real GDP

As indicated in the above Figure, there was a fluctuation of RGDP and on average there was a continuous growth in RGDP. On the other hand, population looks stably growing overtime more which more likely indicates existence of positive relationship between economic growth and population.

Per capita real GDP is often derived from Real GDP i.e. real GDP divided by the midyear population. Per capita Real GDP considers both a country's GDP and its midyear population. A country may have consistent economic growth but if its population is growing faster than its GDP, per capita GDP growth will decline.



Source: World development indicator (2020)

Figure 8. Trends of Real GDP per capita (1990-2019)

4.2. RESULTS OF ECONOMETRIC ANALYSIS

4.2.1. Result of test of stationary

This section reports the stationary test result of our time series study. It is important to make sure that variables are stationary, if not spurious result will be happened which means meaningless. Here a stationary time series has three characteristics namely finite mean, variance and auto covariance overtime (Guajarati, 1995). To test for the stationary (non-stationarity) of the data in the study used for econometric modeling the most common and usual test Augmented Dickey-Fuller test is applied. The test has given the following results which are tabulated below.

Table 1 Result of Test of Stationary (stata result)

Augmented Dickey Fuller test for Variables

	level				**First difference**			
Variables	**Constant without Trend**		**Constant with Trend**		**Constant without Trend**		**Constant with Trend**	
	t-statistics	**5% critical value**	**t-statistics**	**5% critical value**	**t-statistics**	**5% critical value**	**t-statistics**	**5% critical value**
lnRGDPPC	**-2.004**	**-2.989**	**-3.132**	**-3.584**	**-4.156****	**-2.992**	**-4.639 ****	**-3.588**
lnPOGR	**-0.368**	**-2.989**	**-2.208**	**-3.584**	**-3.118****	**-2.992**	**-4.620****	**-3.588**
lnCHPO	**-2.179**	**-2.989**	**-1.214**	**-3.584**	**-3.094****	**-2.992**	**-5.561****	**-3.588**
lnWAPO	**-1.119**	**-2.989**	**-0.948**	**-3.584**	**-4.737****	**-2.992**	**-4.877****	**-3.588**
lnAGPO	**-0.620**	**-2.989**	**-1.994**	**-3.584**	**-6.015****	**-2.992**	**-7.114****	**-3.588**
lnLEXP	**-0.207**	**-2.989**	**-2.432**	**-3.584**	**-5.984 ****	**-2.992**	**-6.844 ****	**-3.588**

**stationary at 5% critical value

Ho: Variable has a unit root

H1: variable is stationary

The result shows that we fail to reject the null hypothesis of unit root for variables at level implying non-stationarity of the variables. However, using their first difference the variables resulted in rejection of the null hypothesis and imply all variables are stationary at first

difference. So the variables are, integrated of order one I (1). So that it will help us to have good regression results with the stationary variables after differencing.

Once we have checked variables are stationary at first difference I (1), the then test for co integration is required to have valid estimate with non-stationary series. This is possible if the linear combination of non-stationary series is stationary.

4.2.2. Co integration Test

Once the variables are difference stationary, it is possible to estimate the model by first difference. However, this gives only the short run dynamics in which case valuable information concerning the long run equilibrium properties of the data could be lost So as to get both the short run and long run relationship one can use the so called co integration (Kennedy, 1992).

Co integration among the variables suggests the presence of long run relationship in the system and long-run causality at least in one direction. So we need to test for Co integration because differencing the variables to attain stationary generates a model which doesn't show the long run behavior of the variables. Here, testing for Co integration is the same as testing for long-run relationship. Considering the assumption of endogenity of variables, the Johansen co integration test is used to test for co integration and to determine the number of co integrating vectors. Here we have developed two models above and we are going to test all econometric tests for these models individually. The first one is the model containing economic development and population growth while the second one is the model containing economic development and selected demographic variables.

Before we are going to test the Johansen test of co integration we have to select our optimal lag length to be included in the model. There are so many tests that can be used to choose a lag length, however AIC and HQ are usual and the efficient ones. According to this criterion, the VAR estimate with the lowest AIC in absolute value is the most efficient one. Therefore, this study mainly used AIC test to choose the appropriate lag length for the model. Using this selection criteria's lag order of four is appropriate for the model. Using these criteria's the optimal lag result is shown below in the table.

Table 2. The optimal Lag selection result (stata result)

Selection-order criteria
Sample: 1994 - 2019 Number of obs = 26

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	253.847				3.3e-15	-19.1421	-19.0724	-18.9002
1	465.231	422.77	25	0.000	2.1e-21	-33.4793	-33.0613	-32.0277
2	506.198	81.933	25	0.000	7.7e-22	-34.7075	-33.9412	-32.0462
3	554.459	96.522	25	0.000	2.7e-22	-36.4968	-35.3821	-32.6258
4	638.087	167.26*	25	0.000	2.4e-23*	-41.0067*	-39.5436*	-35.9259*

4.2.3. Granger causality test

We can test short run Granger causality test from our VAR estimate results: since VAR by its nature has a good framework for examining Granger causality. Here impact of lagged population considered independently may not have a significant effect on the RGDPPC as a one period increment in population (new birth) has no contribution to the economy of the country. However, the cumulative effect of population on real GDPPC can be tested using the well-known Wald test on the estimated coefficients as presented in Table 2 below. Here the null hypothesis is no granger causality. I.e. RGDPPC doesn't cause POGR and POGR doesn't cause RGDPPC. The null hypothesis is accepted when the p value is greater than 0.05 and rejected when p value is less than 0.05.

Table 3. Results of Granger Causality- Wald

Equation	Excluded	chi2	df	Prob > chi2
lnRGDPPC	lnPOGR	1.3e+05	3	0.000
lnRGDPPC	ALL	1.3e+05	3	0.000
lnPOGR	lnRGDPPC	8.6209	4	0.071
lnPOGR	ALL	8.6209	4	0.071

Equation	Excluded	chi2	df	Prob > chi2
lnRGDPPC	lnCHPO	9.9637	2	0.007
lnRGDPPC	lnWAPO	9.0655	2	0.011
lnRGDPPC	lnAGPO	.58693	2	0.746
lnRGDPPC	lnLEXP	.85542	2	0.652
lnRGDPPC	ALL	28.827	8	0.000
lnCHPO	lnRGDPPC	1.4875	2	0.475
lnCHPO	lnWAPO	9.4139	2	0.009
lnCHPO	lnAGPO	6.7658	2	0.034
lnCHPO	lnLEXP	.66026	2	0.719
lnCHPO	ALL	11.575	8	0.171
lnWAPO	lnRGDPPC	.76177	2	0.683
lnWAPO	lnCHPO	2.3061	2	0.316
lnWAPO	lnAGPO	7.5824	2	0.023
lnWAPO	lnLEXP	.42209	2	0.810
lnWAPO	ALL	22.384	8	0.004
lnAGPO	lnRGDPPC	6.9672	2	0.031
lnAGPO	lnCHPO	7.8703	2	0.020
lnAGPO	lnWAPO	8.2527	2	0.016
lnAGPO	lnLEXP	16.721	2	0.000
lnAGPO	ALL	74.144	8	0.000
lnLEXP	lnRGDPPC	12.849	2	0.002
lnLEXP	lnCHPO	20.806	2	0.000
lnLEXP	lnWAPO	11.808	2	0.003
lnLEXP	lnAGPO	.6325	2	0.729
lnLEXP	ALL	40.201	8	0.000

Source: stata calculation

According to the result of the tests listed above it is clear that between RGDPPC and POGR, we have only a unidirectional Causality running from population growth to economic development. The first and very strong causality relationship between RGDPPC and POGR supports our hypothesis stated in the paper that population growth has an effect on economic development. So here population growth strongly causes economic development but there is no causality running from economic development to population growth as shown above at granger causality result.

There is also a causal relationship between real GDP per capita and some selected demographic variables. Here working age population and young population granger causes real GDP per capita. But real GDP per capita didn't cause them. On the other hand, real GDP per capita causes life expectancy at birth and aged population but not vice versa. I.e. there is a unidirectional causality from real GDP per capita to life expectancy at birth and aged population. This causality result is found in the appendix.

4.2.4. Error Correction Mechanism (ECM)

If two variables are not co-integrated or proved to have no long run relationship, the testing procedure will stop and we will not the construct an error correction model. But if they are co-integrated or checked to have a long run relationship we can construct our error Correction mechanism. A very important theorem, known as the Granger representation theorem, states that if two variables Y and X are co-integrated, then the long term or equilibrium relationship that exists between the two can be expressed as ECM (Gujarati 2004). The existence of Cointegration implies the existence of Granger causality at least in one direction (Granger, 1988).

Thus the error correction mechanism (ECM) is a mechanism used to correct any short run deviation of the variables from their long run equilibrium. In other words error correction term has important implication in linking the short-run periods to the long run period. It simply shows the adjustment of the short-run disequilibrium to achieve a long-run equilibrium. So our ECM is explained below after checking the presence of co-integration between variables listed in our model.

Once we have tested cointegration and Granger Causality Tests, we decided to run the ECM test in order to assess long-run relationship between population variables and per capita income. Wooldridge (2012) explained that cointegration between two series implies a particular kind of

model, called an error correction mechanisms or error correction model, for the long and short-term dynamics the error correction mechanism (ECM) was first used by Sargan and later popularized by Engle and Granger to correct for disequilibrium. The existence of Cointegration implies the existence of Granger causality at least in one direction (Granger, 1988). This enables us to use error correction model evaluates the short-run and long-run dynamics in the relationship between the dependent variable (real GDP per capita) and the independent variable (demographic variables).

Case 1: Co integration Test and VECM models for lnRGDPPC & lnPOGR

So proceeding to our co-integration test we have two types of co-integration tests which are given in Table 4 below with the null hypothesis of no co-integrating vector.

Table 4. Co integration Rank Test (stata result)

Johansen tests for cointegration

Trend: constant — Number of obs = 36
Sample: 1984 - 2019 — Lags = 4

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	14	320.08917	.	40.3002	15.41
1	17	340.23654	0.67349	0.0055*	3.76
2	18	340.23929	0.00015		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	14	320.08917	.	40.2947	14.07
1	17	340.23654	0.67349	0.0055	3.76
2	18	340.23929	0.00015		

**Null hypothesis H0: no or 0 co integration

**Alternative hypothesis H1: there is co integration

Decision criteria: If trace or maximum statistic is greater than 5% critical value rejects the null hypothesis. So this implies there is co-integrating equations. So that counting the no of ranks which satisfies this criteria and we have found one co integrating vector.

The result from the above two tests indicates rejection of the null hypothesis of no co integrating vector. Instead the result indicates that the model has single co integrating vector. So that our test suggests that our set of co-integrated time series has an error-correction representation, which shows the long run adjustment mechanism. So to estimate our VECM using the number of co integrating vectors we have to use our optimal lag L* which highly help us to describe the long run relationship of variables in the model. Here in VECM estimation all variables should be endogenous.

The long run and short run causalities between Real GDP (RGDPPC) and population growth (POGR) is analyzed using VECM. Here the advantage of testing causality using VECM enables us to analyze both the long run and short-run dynamics of the economic development and population growth. So from VECM estimation short run dynamics and relationship of economic development and population growth is presented in Table 3 below.

Table 5. Estimation result of VECM Regression

Dependent Variable	**ΔlnRGDPPC**	**ΔlnPOGR**
Regressors	**Coefficients**	
ECt-1	**-.3403809 ****	- .0026381
ΔlnRGDPPC(L1)	.1248047	-.000749
ΔlnRGDPPC(L2)	-.14509	-.0001614
ΔlnRGDPPC(L3)	.0455429	.0002488
ΔlnPOGR (L1)	*23.62285*	.9010981
ΔlnPOGR (L2)	-21.69324	.1904569
ΔlnPOGR (L3)	27.93429	-.5180923
C	.0000454 .	.0058519

Source: stata calculation

When we consider our target variable lnRGDPPC as dependent variable

$$\boldsymbol{\Delta lnRGDPPCt = c + \Delta lnRGDPPCt - 1 + \Delta lnPOGRt - 1 + ECTt - 1}$$

Short run effects are captured through individual coefficients of the differentiated term in which coefficient of the VECM variable contains information about whether the past values of variables affect the current values of the variables under study.

The size and statistical significance of the coefficient of the error correction term, measures the tendency of each role in determining the current outcomes captures the long-run impact. When the error correction term is statistically significant and negative it works to push the dependent variable back toward the equilibrium Gujarati (2008).

From the first model where economic development (RGDPPC) is considered as dependent variable the coefficient ECt-1 (Error Correction term)) is **-0.3403809**, which is negative and statistically significant at five percent significance level. So the coefficient **-0.3403809** indicates disequilibrium in the previous year is adjusted by around 34.0389 percent per annum to the long run equilibrium. That is the speed of adjustment of economic development to its equilibrium level variable to return to the equilibrium.

$$\boldsymbol{\Delta lnPOGRt = c + \Delta lnPOGRt - 1 + + \Delta lnRGDPt - 1 + ECTt - 1}$$

However, considering population POGR as dependent variable the error correction term (ECt-1) is negative but statistically insignificant which means that the error correction term (EC t–1) does not contribute to explain the changes in POGR.

Table 6. The Long runs Equation Johansen normalization (stata result)

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	1	1061.214	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
lnRGDPPC	1	.	.	.	.	.
lnPOGR	-2.952181	.0906237	-32.58	0.000	-3.129801	-2.774562
_cons	8.34364	.	.	.	.	.

Source: stata calculation

This table shows the long run equation often called the johansen normalization restriction from where our error correction term is generated and our target variable is lnRGDPPC.

$$\boldsymbol{ECTt-1=1.lnRGDPPCt-1+2.95lnPOGRt-1+8.34364}$$

Here since there is normalization process, the sign of coefficients are reversed to enable proper interpretation. From the above econometric equation population growth has a positive and significant impact on economic development in the long run. Considering ceteris paribus assumption, when population increases by 1% economic development will increase nearly by 2.95%. So that in the long run population has a positive role for Ethiopian Economy and we can mention various reasons for this. This is also consistent with others finding such as Tartiyus et al. (2015) in Nigeria, Musa (2015) in Nigeria, Gideon et al.(2013) in Kenya, Lachisa and Yirdaw (2013) in Ethiopia which are discussed in the literature review above.

Some diagnostic tests

The results of time series analysis under OLS regression to be unbiased, consistent and efficient outcomes there are preliminary criteria's. These include normality, hetroskedasticity and serial correlation tests. Therefore, to check the validity of our result in this study these diagnostic tests are used.

The Jarque-Bera test (JB) of normality is used and the result showed that the error term from the VECM estimate indicates that the error terms are normally distributed since their p value are greater than five percent significant level as shown in the table below.

Table 7. Jarque-Bera test of normality (stata result)

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_lnRGDPPC	1.560	2	0.45829
D_lnPOGR	1.458	2	0.48238
ALL	3.019	4	0.55473

Equation	chi2	df	Prob > chi2
D_lnRGDPPC	0.189	2	0.90992
D_lnCHPO	0.514	2	0.77339
D_lnWAPO	0.552	2	0.75882
D_lnAGPO	0.865	2	0.64881
D_lnLEXP	0.491	2	0.78214
ALL	2.611	10	0.98915

In the dynamic form of hetroskedasticity where lagged dependent variable is considered as explanatory variable, Engle suggested what is called autoregressive conditional hetroskedasticity (ARCH) model. The test result in this particular study rejects the null hypothesis of no ARCH effect meaning there is no autoregressive conditional hetroskedasticity problem.

The other test, serial correlation occurs in time-series studies when the errors associated with a given time period carry over into future time periods. Residual Serial Correlation LM Test fails to reject the null hypothesis of no serial correlation at lag order of four since all the p values are greater than 0.05 so error terms are not serially correlated. The result is showed in Table 7 below.

Table 7 Results of LM Residual Serial Correlation Test **(stata result)**

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	4.1798	4	0.38222
2	2.2767	4	0.68501
3	7.0950	4	0.13095
4	11.2632	4	0.02376

H0: no autocorrelation at lag order

Case 2: Co integration Test and VECM models for lnRGDPPC and selected demographic variables

Accounting for this, here also lets use two types of co integration tests which are given in Table 8 below with the null hypothesis of no co-integrating vector.

Decision criteria: If trace or maximum statistic is greater than 5% critical value rejects the null hypothesis. So this implies there is co integrating equations. So that counting the no of rank which satisfies this criteria we have found four co integrating vector. So to estimate our VECM using the number of co integrating vectors we have to use our optimal lag L* which highly help us to describe the long run relationship of variables in the model.

Table 8 Co integration Rank Test (stata result)

Johansen tests for cointegration

Trend: constant — Number of obs = 26

Sample: 1994 - 2019 — Lags = 4

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	80	509.10096	.	257.9715	68.52
1	89	560.74452	0.98118	154.6843	47.21
2	96	607.38665	0.97234	61.4001	29.68
3	101	630.36235	0.82922	15.4487	15.41
4	104	637.00429	0.40006	2.1648*	3.76
5	105	638.0867	0.07989		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	80	509.10096	.	103.2871	33.46
1	89	560.74452	0.98118	93.2843	27.07
2	96	607.38665	0.97234	45.9514	20.97
3	101	630.36235	0.82922	13.2839	14.07
4	104	637.00429	0.40006	2.1648	3.76
5	105	638.0867	0.07989		

**Null hypothesis H0: no or 0 co integrating equation

**Alternative hypothesis H1: there is at least one co integrating equation

Decision criteria: If trace or maximum statistic is greater than 5% critical value rejects the null hypothesis. So this implies there is co integrating equations. So that counting the no of rank which satisfies this criteria we have found four co integrating vector. So to estimate our VECM using the number of co integrating vectors we have to use our optimal lag L* which highly help us to describe the long run relationship of variables in the model.

Here this study only considers the first co integrating equation which relates RGDPPC to other selected demographic variables since our concern is to examine the impact of selected demographic variables on economic development. So from VECM estimation short run

dynamics and relationship of economic development and demographic variables is presented in the table at the appendix.

Considering lnRGDPPC as our co integrating equation

$$\Delta lnRGDPPC = c + \Delta lnCHPOt - 1 + \Delta lnWAPOt - 1 + \Delta lnAGPOt - 1 + \Delta lnLEXPt - 1 + ECTt - 1$$

From estimate result in the appendix economic development (RGDPPC) is considered as dependent variable with the coefficient ECt-1 (Error Correction term)) is **-0.222085.** So the coefficient **-0.222085** indicates disequilibrium in the previous year is adjusted by around **22.2085** percent per annum to the long run equilibrium. That is the speed of adjustment of economic development to its equilibrium level.

Here when we see aged population (AGPO) as a co integrating equation its error correcting coefficient **-.0729574** is both negative signed and significant. So this coefficient indicates that disequilibrium in the previous year is adjusted by nearly 7.29 percent yearly to the long run equilibrium.

4.3. Impulse Response Functions (IRF)

The Impulse Response Function (IRF) shows the response of a variable to a unit standard deviation shock to itself and other variables in the model. It shows how a variable respond in to time horizon to shock (a sudden unexpected change) in the variables and other variables in the model (Abubakar and Bala, 2016). The following figure shows the shock response of RGDPPC to lnPOGR, lnCHPO, lnWAPO, lnAGPO and lnLEXP.

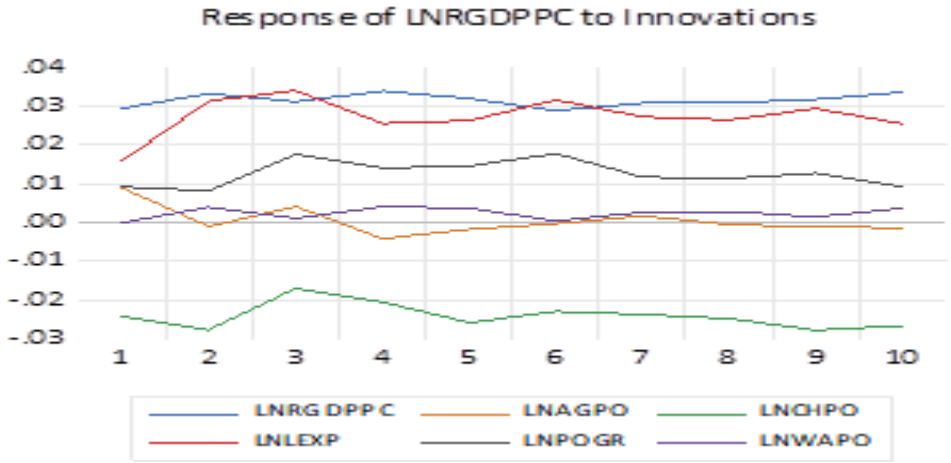


Figure 8. Response of lnRGDPPC to innovations

Table 9. The Long run Equation Johansen normalization (stata result)

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	4	2556.175	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
lnRGDPPC	1	.	.	.	.	.
lnCHPO	1.220539	.3872311	3.15	0.002	.4615795	1.979498
lnWAPO	-15.87343	.7350011	-21.60	0.000	-17.31401	-14.43286
lnAGPO	11.39912	.9511321	11.98	0.000	9.534937	13.26331
lnLEXP	1.567515	1.359771	1.15	0.249	-1.097587	4.232617
_cons	33.44633	.	.	.	.	.

This table shows the long run equation often called the johansen normalization restriction from where our error correction term is generated and our target variable is lnRGDPPC. After imposing this normalization restriction by the Johansen method, the co-integrating equation for real GDPPC growth is estimated.

$$ECTt - 1 = 1.lnRGDPPCt - 1 - 1.22lnCHPOt - 1 + 15.88lnWAPOt - 1 - 11.39lnAGPOt - 1 - 1.56lnLEXPt - 1 + 33.44$$

All the variables which are expected to explain economic development (lnRGDPPC) are significant except life expectancy at birth (lnLEXP).

The child population (CHPO) which is economically dependent (aging 0-15) has a negative sign and is statistically significant in explaining economic development in the long run. That can be interpreted as when young aged population increases by 1% economic development (RGDPPC) decreases by 1.22%, **Ceteris paribus**. The finding of this study shows that an increase in younger population discourages economic development i.e. RGDPPC in the long run.

This implies that when there is higher fertility rate in a given period of time the proportion of the young age population (i.e. below 15) grows higher relative to the working age population (aged

15-64) population. This change in age composition has an adverse impact on Ethiopia economy by diverting resources to non-productive segments of the population for food supplies, schooling, health care, other infrastructures etc. so that it has an effect on economic development by depressing savings, investment, foreign exchange, and human capital. Thus our finding is persistent in line with our hypothesis and reviewed literatures.

According to the result of our long run equation the reverse is true for working age segments of the population(WAPO) when fertility rates decline over a period of time the proportion of the working age population (i.e. over 15) grows relative to the economically dependent youth population. This change in age composition creates a good opportunity for a country in which it can potentially raise its level of savings and investment. This finding encouraged a subsequent reconsideration of the potential importance of reducing fertility in pursuit of growth.

Thus our econometric result also shows that the middle aged population (WAPO) which is economically active has a significant and positive impact on economic development. Thus it can be interpreted as when economically active population or the middle aged population increases by 1% RGDPPC will increase by 15.88% at **Ceteris paribus**.

Though there is employment problem this median age group contributes positively to the economic development which means the higher median age or economically active segments of the population the higher economic development they are matured to work, there becomes cheap labor force and strive a lot then help the economy. The higher segment of the median age implies the availability of cheap labor force resource for Ethiopia since higher labor force implies the existence of high productive man power which is a key for countries economy if utilized properly taking in to account for the growing new labor force entrants.

As literatures suggested above this segment of the population leads to the accelerated economic growth due to changes in the age structure of a country's population as it shifts from high to low birth and death rates during a demographic transition which is commonly referred to as demographic dividend lead growth. This economic growth results from a decline in a country's mortality and fertility and the subsequent changes in the age structure of the population. As a country's working-age population grows in compared to the number of young dependents, the country has a good opportunity for stronger economic growth.

But this age group needs greater attention since unemployment problem is a threat by itself. Here in this age group there are three main categories to be handled properly by the government of Ethiopia: employed, unemployed and not in labor force. So unless the economic system or the government handled it properly this may cause socio economic and political crises since unemployed individuals are highly exposed to social unrest activities which have also been a case to Ethiopia.

Here this working age segment of the population in a demographic dividend needs appropriate policies and efficient use of resources. The policies and strategies of the country should not only focus on creating employment, but also selective, essential and productive employment has to be created. In line with this employment creation, policy actions should be able to address the root causes of underemployment such as low productivity and low access to resources. The most wise and effective interventions in this regard should focus on skills development through quality education, training, and increased access to means of production for active labor force.

The government also must give greater attention for foreign direct investment (FDI) and private sectors by creating conducive business environment with strong quality institutions and macroeconomic policies since they can create a good and productive employment opportunity.

To sum up, our finding on the above demographic variables i.e. working age population and young population age groups is consistent with the findings of Song (2013), Wongboonsin and Phiromswad (2017), Bloom et al. (2007), etc. who founds a negative influence of young population growth on economic growth and positive effects of growth in the working-age population .

Here according to the econometric result in the long run aged population (AGPO) has a negative and significant effect for economic development. Its coefficient can be interpreted as when aged population increases by 1% economic development will decrease by 11.39%, ceteris paribus.

This is because as we have mentioned in our modeling section this segment of the population is aged population which are one of the dependent section of the population which has a negative impact on economic development. Here this section of the population is dependent since as a developing country Ethiopia lacks social welfare services, retirement incomes, pensions and other social security means. So this section of the society faces miserable life since they didn't

have previous formal income which can help them when they became old. Mason and Lee (2008) also founded that the longer life span the higher old age consumption which affects countries economy negatively. By these and other reasons these section of the population becomes dependent and retards the economy which is also in line with our literature above.

The last variable in this model is life expectancy at birth and it is signed positive but the result shows that its impact is insignificant. Life expectancy in Ethiopia may have insignificant effect on economic development since income may not increase as life span increase.

5. CHAPTER 5: Conclusion and Recommendation

5.1. Conclusion

The study is based on a time series data covering a time period of 1990 to 2019 and analyzed the relationship between population (with other demographic variables) and economic development (Real GDP per capita is used as a proxy). Both descriptive and econometric methods of analysis were employed. The descriptive analysis shows existence of high population growth in Ethiopia. This is evidenced by persistent and large gap between birth rate and death rate where the birth rate is on average was greater by around 27 per 1,000 Population. In addition, the doubling time of the population is declining. Based on the trend of population and economic growth while there exist a persistence increment in population size and real GDP, there is slight fluctuation in the real GDP overtime.

Considering econometric analysis, the study employed different tests such as unit root, co-integration, and Granger causality tests and vector error correction model. The unit root test indicates that the variables considered are stationary at first difference. The co-integration test using Johansen test (trace and maximum eigenvalue tests) shows that population and real GDP per capita has co-integrating vector and also real GDPPC has also co-integration with the above mentioned selected demographic variables.

Based on this, a VECM with an optimal lag length of four were estimated considering real GDP per capita and Population as dependent variables in two different models. According to the estimation result, population Granger causes real GDP per capita i.e. Only unidirectional causality from population to economic development, there is no Granger causality from real GDP per capita to population. On the other hand, taking economic development as dependent variable the short run speed of adjustment as measured by the coefficient of error correction term adjusts that a previous year shock (disequilibrium) 34.0389 percent per annum in the model.

There is also a causal relationship between real GDP per capita and some selected demographic variables. Here working age population and young population granger causes real GDP per capita. But real GDP per capita didn’t cause them. On the other hand, real GDP per capita causes

life expectancy at birth and aged population but not vice versa. I.e. there is a unidirectional causality from real GDP per capita to life expectancy at birth and aged population.
In the long run population growth, economically active (working age) segment of the population (WAPO) has positive and significant effect on economic development while young population group (CHPO), aged group (AGPO) has a negative and significant effect on economic development.

5.2. Recommendation

The economic, social and political status of women has direct bearings on the level of fertility in any society. Where women's roles are exclusively defined in terms of household management and marital duties, as is the case in Ethiopia, they are subjected to the expectation that they replenish the race by bearing a large number of children and assume full responsibility for maintaining them almost single handedly.

Once we have concluded that still there is higher population growth in Ethiopia i.e. an increasing birth rate (implying higher young age dependency) with ups and downs in real GDP per capita. As the finding above shows Ethiopia is under stage two of demographic transition which is characterized by lower death rate but higher birth rate. This shows the need to revise population policy and decrease fertility rate by using different family planning technics and contraceptive methods. In addition to this improving the social and economic status of women is a key for a decrease in fertility rate. The development of old-age and other social security systems outside the extended family network can also be a solution to lessen the economic dependence of parents, especially women, on their offspring since the study indicated that aged population affects economic development significantly and negatively.

High fertility and rapid population growth exert negative influences on economic and social development and low levels of economic and social development provide the climate favoring high fertility and hence rapid population growth.

Once we have still growing population it is better to decrease growing population growth rate and expanding education, health and standard of living to have healthy, productive and successful population. So in line with decreasing fertility rate creating human capital

development is a key for countries economic development so greater attention must be given to this. Ethiopia has a promising segment of young population once very trained, educated and experienced its economy will expand

Generally, in order to design and implement realistic policies regarding population issues that affect economic performance of the country, further researches should be studied. Moreover, effective policies should be prepared to adjust/control high rate of population growth and make it beneficially resource of the economy based on the results of reporting the researches.

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7. Appendices

Data Employed

year	RGDPPC	POGR	CHPO	WAPO	AGPO	LEXP	lnRGDPPC	lnPOGR	lnCHPO	lnWAPO	lnAGPO	lnLEXP
1990	767.01	47.89	22.17	24.20	1.51	46.92	6.64	3.87	3.10	3.19	0.41	3.85
1991	687.54	49.61	23.05	24.99	1.56	47.30	6.53	3.90	3.14	3.22	0.44	3.86
1992	605.77	51.42	24.07	25.74	1.61	47.69	6.41	3.94	3.18	3.25	0.48	3.86
1993	661.31	53.30	24.85	26.79	1.66	48.07	6.49	3.98	3.21	3.29	0.51	3.87
1994	659.09	55.18	25.73	27.74	1.71	48.60	6.49	4.01	3.25	3.32	0.54	3.88
1995	676.59	57.05	26.57	28.71	1.76	49.12	6.52	4.04	3.28	3.36	0.57	3.89
1996	736.95	58.88	27.47	29.59	1.82	49.65	6.60	4.08	3.31	3.39	0.60	3.90
1997	737.33	60.70	28.32	30.49	1.88	50.17	6.60	4.11	3.34	3.42	0.63	3.92
1998	691.22	62.51	29.15	31.42	1.95	50.70	6.54	4.14	3.37	3.45	0.67	3.93
1999	706.16	64.34	30.37	31.97	2.01	51.28	6.56	4.16	3.41	3.46	0.70	3.94
2000	727.77	66.22	30.77	33.40	2.05	51.86	6.59	4.19	3.43	3.51	0.72	3.95
2001	765.81	68.16	31.29	34.75	2.12	52.45	6.64	4.22	3.44	3.55	0.75	3.96
2002	755.43	70.14	32.67	35.29	2.18	53.03	6.63	4.25	3.49	3.56	0.78	3.97
2003	718.33	72.17	33.99	35.93	2.24	53.61	6.58	4.28	3.53	3.58	0.81	3.98
2004	793.09	74.24	34.56	37.37	2.31	53.01	6.68	4.31	3.54	3.62	0.84	3.97
2005	862.36	76.35	35.35	38.62	2.30	55.80	6.76	4.34	3.57	3.65	0.83	4.02
2006	929.69	78.49	36.26	39.75	2.47	56.89	6.83	4.36	3.59	3.68	0.90	4.04
2007	1,008.14	80.67	37.16	40.94	2.57	57.99	6.92	4.39	3.62	3.71	0.94	4.06
2008	1,086.70	82.92	37.94	42.31	2.67	57.20	6.99	4.42	3.64	3.75	0.98	4.05
2009	1,150.21	85.23	38.67	43.78	2.78	60.00	7.05	4.45	3.66	3.78	1.02	4.09
2010	1,259.02	87.64	39.38	45.37	2.89	60.93	7.14	4.47	3.67	3.81	1.06	4.11
2011	1,360.94	90.14	40.03	47.11	3.01	61.85	7.22	4.50	3.69	3.85	1.10	4.12
2012	1,437.38	92.73	40.67	48.93	3.12	62.78	7.27	4.53	3.71	3.89	1.14	4.14
2013	1,545.18	95.39	40.92	51.22	3.24	63.70	7.34	4.56	3.71	3.94	1.18	4.15
2014	1,656.63	98.09	41.92	52.81	3.36	64.15	7.41	4.59	3.74	3.97	1.21	4.16
2015	1,779.08	100.84	42.53	54.83	3.48	64.61	7.48	4.61	3.75	4.00	1.25	4.17
2016	1,894.90	103.60	43.22	56.78	3.52	65.06	7.55	4.64	3.77	4.04	1.26	4.18
2017	2,021.56	106.40	43.89	58.80	3.71	65.52	7.61	4.67	3.78	4.07	1.31	4.18
2018	2,103.51	109.22	44.55	60.86	3.82	65.97	7.65	4.69	3.80	4.11	1.34	4.19
2019	2,219.71	112.08	45.21	62.93	3.94	66.34	7.71	4.72	3.81	4.14	1.37	4.19

Note: Real GDP per capita is measured at constant 2017 International Dollars and population (POGR), CHPO(child population), WAPO(working age population) and aged population(AGPO) are in millions while LEXP(life expectancy at birth is measured by the number years stayed at birth)

Source :world development indicators(2019) , world population prospects 2019, united nations - world population prospects(2020)

Table 2: Results of Vector auto regression (lnRGDPPC and lnPOGR)

Equation	Parms	RMSE	R-sq	chi2	P>chi2
lnRGDPPC	9	.03276	0.9957	1940377	0.0000
lnPOGR	9	.000196	1.0000	1.25e+08	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnRGDPPC						
lnRGDPPC						
L1.	.7547906	.1654058	4.56	0.000	.4306012	1.07898
L2.	-.3403794	.1813128	-1.88	0.060	-.6957459	.0149871
L3.	.1981243	.1676505	1.18	0.237	-.1304646	.5267132
L4.	-.0957153	.1220017	-0.78	0.433	-.3348343	.1434037
lnPOGR						
L1.	20.59445	4.758343	4.33	0.000	11.26827	29.92064
L2.	-31.86311	.	.	.	.	.
L3.	40.81616	13.99289	2.92	0.004	13.39059	68.24172
L4.	-28.27673	10.42141	-2.71	0.007	-48.70231	-7.851138
_cons	-3.169217	.7044055	-4.50	0.000	-4.549826	-1.788607
lnPOGR						
lnRGDPPC						
L1.	.001733	.0009908	1.75	0.080	-.0002088	.0036749
L2.	.0001921	.0010861	0.18	0.860	-.0019365	.0023208
L3.	.0004576	.0010042	0.46	0.649	-.0015107	.0024258
L4.	-.0005296	.0007308	-0.72	0.469	-.0019619	.0009027
lnPOGR						
L1.	1.870837	.0285021	65.64	0.000	1.814974	1.926701
L2.	-.6358598	.	.	.	.	.
L3.	-.7578817	.0838165	-9.04	0.000	-.9221589	-.5936044
L4.	.5165747	.0624235	8.28	0.000	.3942268	.6389226
_cons	.0260691	.0042193	6.18	0.000	.0177993	.0343388

Table 3: Estimation result of VECM Short run Dynamics

Dependent Variables	**lnRGDPPC**	**LnCHPO**	**lnWAPO**	**lnAGPO**	**lnLEXP**
Regressors	**Coefficients**				
ECT-1	**-.222085****	-.0116723	.0123986	**-.0729574****	.0143319
D.lnGDPPCL1	.2192984	-.0761818	.0629232	-.031816	**.1417191*****
D.lnGDPPCL2	-.2409114	-.0123085	.0012383	-.047199	.1144422
D,lnGDPPCL3	.1788201	.0507595	-.0513725	-.0545627	.076999
D.lnCHPO(L1)	7.146636	1.414395	-.8431756	2.048639	2.465088
D.lnCHPO(L2)	.2396612	.3744826	-.005788	3.999061	-.07962.
D.lnCHPO(L3)	1.490711	-.1068294	-.0747722	4.808539	-.7579526
D.lnWAPO(L1)	7.01648	1.524242	-.8899853	1.770576	2.295035
D.lnWAPO(L2)	-2.553761	.7437147	-.3064688	-4.135784	-1.713261
D.lnWAPO(L3)	1.250946	-.5921146	.3343792	5.235476	-1.886348
D,lnAGPO (L1)	1.97748	.0822732	-.07962	.3216251	-.028216
D,lnAGPO (L2)	2.484299	-.1316911	.1191628	**.7370706****	-.1998352
D,lnAGPO (L3)	2.516933	-.119497	.1229144	**1.07616 ****	.1900388
D,lnLEXPO(L1)	2.397345	-.0062477	.0358771	**1.1344***	-.502477
D,lnLEXPO(L2)	1.360777	.0780345	-.034013	**.79999****	-.3851932
D,lnLEXPO(L3)	.3810797	.1084066	-079325	**.36833*****	-.3598725
C	.0092861	-.0327671	.041633	-01466	.0065351

Note: * significant at 1% **significant at 5% and ***rarely significant at 10%

Table 4. Granger causality Wald tests between RGDPPC and other demographic variables

Equation	Excluded	chi2	df	Prob > chi2
lnRGDPPC	lnCHPO	9.9637	2	0.007
lnRGDPPC	lnWAPO	9.0655	2	0.011
lnRGDPPC	lnAGPO	.58693	2	0.746
lnRGDPPC	lnLEXP	.85542	2	0.652
lnRGDPPC	ALL	28.827	8	0.000
lnCHPO	lnRGDPPC	1.4875	2	0.475
lnCHPO	lnWAPO	9.4139	2	0.009
lnCHPO	lnAGPO	6.7658	2	0.034
lnCHPO	lnLEXP	.66026	2	0.719
lnCHPO	ALL	11.575	8	0.171
lnWAPO	lnRGDPPC	.76177	2	0.683
lnWAPO	lnCHPO	2.3061	2	0.316
lnWAPO	lnAGPO	7.5824	2	0.023
lnWAPO	lnLEXP	.42209	2	0.810
lnWAPO	ALL	22.384	8	0.004
lnAGPO	lnRGDPPC	6.9672	2	0.031
lnAGPO	lnCHPO	7.8703	2	0.020
lnAGPO	lnWAPO	8.2527	2	0.016
lnAGPO	lnLEXP	16.721	2	0.000
lnAGPO	ALL	74.144	8	0.000
lnLEXP	lnRGDPPC	12.849	2	0.002
lnLEXP	lnCHPO	20.806	2	0.000
lnLEXP	lnWAPO	11.808	2	0.003
lnLEXP	lnAGPO	.6325	2	0.729
lnLEXP	ALL	40.201	8	0.000

Figure 1. Impulse Responses of lnPOGR, lnCHPO, lnWAPO, lnAGPO and lnLEXP to RGDPPC