

RESEARCH ARTICLE

# Panel Data Analysis of Employment and Unemployment in Sub-Saharan Africa and its Impact on Annual Percentage Change in GDP Growth

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## Abstract:

Sub-Saharan Africa has over the years been exposed to diverse arguments and agitations about the provision of employment to alleviate poverty in the sub region with the aim of achieving full employment. Whereas some economists and bibliographers believe of the significant impact that employment and unemployment have on annual percentage change in GDP growth, some do not. The main objective of the study is to access the impact that employment and unemployment have on annual percentage change in GDP growth in Sub-Saharan African countries using annual data from 2000 to 2014 collected from the World Bank. Two statistical models, the Pooled Ordinary Least Square (OLS) regression model and the Least Square Dummy Variable (LSDV) regression model with fixed effect, are used in the study. Empirical evidence shows that both models are statistically significant but LSDV model explains a greater percentage than the Pooled OLS for employment on GDP growth rate. Further empirical analysis of the study also reveals a positive relationship between annual percentage change in GDP growth and employment rate for the female population, employment rate for the male population and employment rate for the total youth population. Also, an inverse relationship exists between unemployment rate for male youth population (15-24years), and female youth population (15-24years) on annual percentage change in GDP growth. The study can be improved by considering other factors that impact GDP growth other than employment and unemployment.

Keywords: Employment, Unemployment, GDP growth rate, Pooled OLS regression model, LSDV regression model.

## Introduction

Sub-Saharan Africa has over the years experienced series of challenges regarding employment provisions for the youth of working class as well as the entire population in general which has had a massive impact on the rate of growth of the region's Gross Domestic Product (GDP). Whereas many factors contribute to the development of a country, this study looks at employment and unemployment among the other factors and its contribution to annual percentage change in GDP growth rate. Employment and unemployment in Sub Sahara African countries compared to other regions of the world seems to be the root cause of poverty in the region.

Individuals in any geographical area may be employed in one way or the other being it formal or informal. Despite the trusted and believed economic virtue of a pro-employment growth in the fight against poverty and equality among individuals, employment and economic growth do not seem to be getting along in Africa since the colonial era. Most nations in the region are suffering growth due to political instability, greediness, and lack of technical skills. The pre-assumed growth is not materializing as predicted. Unemployment, an economic phenomenon where a person who is classified as part of the labor force (16 years and above) is actively searching for a job but cannot find one at the labor market. Unemployment can be in diverse forms. It could be due to a change in the structure of the economy. The advancement of an economy due to technological change can render individuals unemployed. Unemployment can also be caused out of individuals moving from one job to another which economically is defined as frictional unemployment. Relatively lower level of employment and higher unemployment rate perpetually reduces Gross Domestic Product (GDP) thereby reducing economic growth and having a significant fall in the standard of living of individuals.

Gross Domestic Product (GDP) is a monetary measure of the market value of all final goods and services produced in a period (quarterly or yearly) or the monetary value of all the finished goods and services produced within a country's borders in a specific period. GDP is used as a proxy variable for economic growth. The greater the monetary value of this measure, the more likely the economy or country can develop or grow. Countries with a higher value of GDP are more likely to develop than those with a lower GDP. GDP growth rate on the other hand measures how fast the economy is growing. It is however driven by four components which include consumption, business investment, government spending and imports and exports.

Sub-Saharan Africa has over the years been exposed to a lot political talks and agitations about the provision of pro-employment to alleviate poverty in the sub region with the aim of achieving full employment where the country's economy is seen as efficient.

Among other goals such as equal distribution of income. Empirically, an unemployment rate of 4-5% is seen as a full employment economy and is however an important yardstick in many developing nations where unemployment and underemployment are major causes and consequences of widespread poverty. In sub Saharan African countries, despite the very high-sounding promises of

political leaders in provision of pro-employment for the populace, high growth rate in terms of GDP remains a mirage. High rate of unemployment, unimpressive growth rates and poverty among other miseries of the populace, are the order of the day.

A lot of works has been done in the developing countries which has helped them re-strategized their economy to increase productivity and enhance growth. However, nothing of such sort has been done in Africa. This work seeks to investigate the impact that employment and unemployment has on annual percentage change in GDP growth rate, an indicator of economic growth.

The general objective is to assess Employment and Unemployment in sub-Saharan African countries and its contribution towards annual percentage change in GDP growth in the sub region.

Specifically,

- To know the effect of demographic engagement in employment activities in these countries.
- To perform individual economy analysis of the variables, understudy in terms of each independent country.
- To establish the actual effect of employment as a tool for development in the economies of the sub Saharan African region as well as the impact of unemployment on GDP growth, a proxy variable for economic development.

A secondary data for this study is obtained from the World Bank website over the years from 2000 to 2014. This data is the World Development Indicators (WDI) which is being undertaken annually over the continent. The WDI data contains data on surveys undertaken in the diverse fields of various continents of the world. Some of these research areas are insurance and finance, transport services, employment and unemployment, agriculture, education, health, energy, international trade, household expenditure, labor force etc. in all countries in the world. The study looks at the Pooled OLS and the Least Square Dummy Variable (LSDV) regression model. Statistical tools such as STATA, SPSS and EXCEL are used for the statistical analysis explained above to derive the causal relationships between the variables listed in the study.

## Literature review

Diverse studies on the impact of employment and unemployment on GDP growth rate indicates in one way or the other the positive impact of employment on GDP and a negative impact of unemployment on GDP growth. Sub-Saharan African region is one of the regions with low growth rate globally and this is as a result of the impact of unemployment and possible mismanagement of resources. According to (Martins, 2013), despite the believed virtue of a pro-employment growth in the fight against poverty, employment and economic growth do not seem to be getting along in Africa over the years.

According to reports from the World Bank, the GDP growth rate in Sub Sahara Africa was seen rising between 2016 and 2017. In its latest report, the Bank reported to have seen an expansion of 2.6percent (2017) and further projected an increase to 3.2percent in 2018 and 3.5 a year after (2019). It also reported that growth rate is not uniform throughout sub-Saharan Africa and that oil exploring countries such as Kenya, Burkina Faso, and Senegal have recorded increase from 5.64 and 6.5 percent in 2015 to 6.8 percent in 2016 respectively

(Boumphrey, SEPTEMBER 22ND, 2014). The rate of unemployment according to latest reports from the World Employment Social Outlook was projected to stand at 7.2percent in 2017 as it was in 2016. Though expected to remain constant through the one year period, 2016 to 2017, the report projected an increase in the number of unemployed from 28million as at 2016 to 29million in 2017 due to a large increment in the regions labor force, possibly more people entering into the working class range (thus 16-65years). It can be noted from reports that Sub-Saharan Africa is faced with the problem of poor-quality-employment rather than unemployment and seem not to realize any change from time to time. According to reports from WESO, across Sub Sahara Africa, the lack of productive opportunities for the youth and adults of working class indicated a minimum of 247million of the populace in vulnerable employment in 2016 equivalent to 68percent of all those with jobs. It is also estimated that, while a marginal decrease in the rate of vulnerable employment is expected in the next 2years as a result of growth in the working-class population, 14.6million people is also expected to add up to the population of vulnerable employment. The report from WESO stated that economic growth in the Sub-Saharan region has been at its lowest over the past two decades. Generally, the labor market is affected by availability and demand for workforce. It is a component of availability of labor force to meet the demands of the market in the production of goods and services. The underlying features of a labor market comprises of the rate of employment, rate of unemployment and availability of job vacancies for the working class. Hence the basic idea is about employee-to-employer match (characterized by skills, working experience and education level of the human capital), earnings (salary), and description of employment class size. The efficiency of the labor market is thus a product of the effect of the trend of the workforce and the employer's needs. Hence, basically the question that arises then becomes as to whether the job-seeking populace meet the required qualifications of the employers in the job market. This is because; technology is taking over the work of the populace. So, the question then arises again that, does the hungry working class have the required skill and/or knowledge needed to replace the technology that has been introduced to the job market? And how fast and quick can the services of humans compete that of machinery or technology? Taking all these into account, every now and then we have people losing jobs as a result of employers laying off workers. Technology is taking over human power; it is up to the job seeking populace to equip themselves better with technology in order to catch up with the changes in the labor market.

### *Trend and features of employment/unemployment in Sub-Saharan Africa.*

Unemployment has been a major challenge globally, especially among the youth. According to reports from World Bank, World Employment and Social Outlook (WESO), International Labor Organization (ILO), United Nations (UN) etc. the rate of unemployment is globally on the rise and seems not to be dropping any further and the case of Sub-Saharan is of no exception. We have more people entering the working force than those exiting with little or nothing been done to create jobs to cater for the increasing rise in labor force. According to reports from World Employment and Social Outlook, the rate of unemployment as at 2015 was 197.1million worldwide and was estimated to rise

by about 2.3million in the following year 2016 to reach 199.4million. It also projected that an additional 1.1million jobless will likely be added to the global tally in 2017(WESO 2017). Sub-Saharan Africa is a region characterized by a bulge of youths (15-24years), 20% of the total population, taking 40% of the working force (employed) and 60% of those unemployed. This clearly points out the severity of the situation at hand. Thus, in natural terms we have the working force comprising of people aged 15 to 65 years. 40% of the total working force belonging to only youth of 15 to 24 years implies the rest aged 25 to 65years covering a wider percentage of the overall population. This implies a higher percentage of the people belonging to the unemployed than those with employment. According to reports by International Labor Organization, about 75million youth (15years to 24years) were unemployed as at the year 2011 across the continents of the world. This indicated an increase of more than 4million since the beginning of the global financial and economic crisis in 2007 with nearly 20% of those in Africa (ILO, 2012). In 2011, youth unemployment in Sub-Saharan Africa was a little higher than the recorded global average of 12.8% but North Africa was seen to have recorded the highest (thus 27.1% throughout the regions of the world (Anyanwu, 2014).

Youth unemployment is also a serious issue among women in the Sub region and in Northern Africa. The ILO also reported that the unemployment rate for young women especially in Northern Africa was approximately 34.3% while the rate for younger men was 18.5% and all the two figures were seen to be the highest worldwide. Youth employment is currently a global policy issue because it has the potential of increasing the economic growth, promoting political and social stability, positively affecting progress towards the Millennium Development Goals and poverty reduction overall. It also leads to better social equality among the youth of any region and results in efficient resource allocation, increased productive potential and low dependency ratio (Ncube and Anyawu, 2012). In Africa where about 200million young people between the ages 15 to 24 (representing about 20% of the continents population) urgently needs both gainful and dignified employment. Current figures shows that the continent has the youngest population globally while projections indicates that by the year 2030, nearly 1 in 4 young people in the world will be from Africa indicating that the overall population of the continent is increasing at an increasing rate and never dropping hence the need for attention in the areas of employment creation and thus eradicating poverty. This is because we are going to have more people entering the working class to search for jobs which is not enough and thus leading to poverty in the long run. One factor that is thought of to be the sustaining factor for youth unemployment is education. This is because we usually have more people entering educational institutions in Sub-Saharan Africa to pursue various educational qualifications to equip or prepare them for the job market.

The informal sector is very vital in the economies of the countries in Sub-Saharan Africa, contributing about 25 to 65 percent of GDP and accounting for between 30 and 95percent of total nonagricultural employment. Most countries in the Sub Saharan region is likely to have a large informal sector for many years to come presenting both opportunities and challenges for policymakers. The informal sector is largely found in most developing economies such as those in Sub-Saharan Africa. The other sector, the formal sector including those underground operating production firms whose activities are performed by registered firms but may be concealed from the authorities to avoid compliance with regulations or the payment of taxes. On the brighter side, the informal

sector provides a welcome pool of jobs particularly important in countries where the demographics are such that there is a large and growing working age population that outstrips the pace of job creation in the formal sector. The informal sector however tends to contain relatively low productivity activities so that large informal sector perpetuates low productivity in the economy. That is to say that, as the share of the informal sector increases, productivity gains are likely to materialize, and the tax base likely to expand. This will in turn facilitate revenue generation required to finance public services to sustain the development process. The challenge for the government then becomes to create an economic environment in which the formal sector can survive while creating job opportunities for those working in the informal sector to improve their living standards. In Sub-Saharan Africa, it is estimated that there is a considerably large size of informal sectors, especially in oil exporting countries averaging 38% of GDP during the period of 2010 to 2014. As a solution to tax evasion, tax policies and revenue administrations should work to improve tax compliance. As household enterprises act a solution to large and growing working age population, authorities need to apply a balanced approach to formalize the informal sector and focus on nurturing the gains from productivity rather than attempting to increase tax revenues from household enterprises.

#### *Previous works using panel data analysis and different models.*

Muhammad Shahid in his paper on the impact of labor force participation on economic growth in Pakistan modelled the economy using a Cobb-Douglas production function for determining output or GDP. Hence finding the impact of labor force participation on economic growth and development where GDP was used as a proxy variable of economic development. The pooled Ordinary Least Square regression model was used to measure the impact. In the case of multiple comparison of different countries, the pooled OLS cannot be used.

(Benites, 2016) modelled the evolution of employment and population ratio in developed countries using modified Okun's law with rate of change of real GDP per capita as a driving force. Empirical analysis of the study revealed that the evolution of employment rate since 1970 for the developed countries can be predicted with higher accuracy by a linear dependency on the logarithm of real GDP per capita. Mujahid Zafar (2012) investigated the economic growth on the female labor force participation from a time series data obtained from 1980 to 2010 of Pakistan. The Autoregressive Distributed Lag (ARDL) technique was used in his analysis to determine the nexus between economic growth and female labor force participation. Lag values of female labor force participation was used in the analysis even though other regressors affect economic growth in the country. Mehab (2007) used logit and probit technique to determine the factors that affect employment and labor force participation. Minh Quang Dao in the study of employment and female labor force participation in developing countries, fitted a pooled OLS regression model. (Kaur, 2015) used a Pooled regression model to analyse economic growth and female labor force participation verifying the U-feminization hypotheses. New evidence for 162 countries over the period 1990-2012.

(Alomian et al., 2019) investigated the relationship between GDP and unemployment using log-linear models. An inverse relationship was found to exist between GDP and unemployment as indicated in Okun's law. Similar to this is (Mosikari, 2013). (Gedek et al., 2017) studies change in GDP and the

employment and unemployment in the European Union. Evidence revealed an inverse relationship between unemployment and GDP and a positive relationship between employment and GDP.

(Mosikari, 2013) examines the causality relationship between immigration, unemployment, and economic growth of OECD countries. The study employed the panel Granger causality testing approach. Result from the study showed that only in Portugal, unemployment negatively causes immigration, while in any country, immigration does not cause unemployment. On the other hand, our results show that, in four countries (France, Iceland, Norway and the United Kingdom), growth positively causes immigration, whereas in any country, immigration does not cause growth. (Noor et al., 2007) studies the relationship between output and unemployment in Malaysia and answers the question, does Okun's law exist. GDP and unemployment data were obtained from 1970 to 2004. Empirical analysis of the data revealed and confirmed Okun's law, a negative relationship between output and unemployment.

## Methodology

The research investigates the impact of employment and unemployment rates on GDP growth rate. Africa, a continent well known for its rich resources tends to face problems with economic growth. According to the African Economic Outlook over the years, when issues of productivity are enhanced in an economy, the economy grows. Productivity works together with employment which is a major problem facing developing countries. Following the increasing population with limited technical know how to create businesses to engage individuals in the economy to improve lives and the socio-economic wellbeing, several of the populace in Africa are unemployed. In addition, unlike the developed countries where the youth (15-24) even if schooling, are actively engaged in productive activities which aids in the growth of the economy, Africa is not the case. Majority of the youth in Africa do not participate in the labor force and they depend solely of their families for daily bread. The study therefore assesses the impact that employment and unemployment in the populace and amongst the youth have on annual percentage GDP growth, a proxy variable for economic growth and development. In addition, following most studies the inflation rate is also considered as an explanatory factor on GDP growth rate.

## Data source and description of the data

World Development Indicators (WDI) data is obtained from the World Bank website for the years from 2000 to 2014 across 12 Sub-Saharan West African countries, including Equatorial Guinea, Gabon, Ethiopia, Uganda, Zambia, Zimbabwe, Botswana, Namibia, Cote d'Ivoire, Gambia, Ghana and Nigeria. The sample size hence is 180. The World Development Indicator (WDI) is undertaken annually in countries across all continents of the world.

GDP is defined as a monetary measure of the market value of all final goods and services produced in a period (quarterly or yearly). It can also be defined as the monetary value of all the finished goods and services produced within a country's borders in a specific period. GDP is used as a proxy variable for economic growth. The greater the monetary value of this measure, the more

likely the economy or country can develop or grow. GDP growth rate on the other hand measures how fast the economy is growing, driven by four components of which include consumption, business investment, government spending and imports and exports.

The World Bank's World Development Indicator (WDI) classifies Employment and Unemployment in two broad classifications; the youth and the entire population. This is further grouped by gender. The data available per the WDI on Employment and Unemployment rate are;

- Employment rate between the ages of 15-24 for males.
- Employment rate between the ages of 15-24 for females.
- Employment rate between the ages of 15-24 for the entire youth population.
- Employment rate between the ages of 15-65 for males.
- Employment rate between the ages of 15-65 for females.
- Employment rate between the ages of 15-65 for the entire population.
- Unemployment rate between the ages of 15-24 for males.
- Unemployment rate between the ages of 15-24 for females.
- Unemployment rate between the ages of 15-24 for the entire youth population.
- Unemployment rate between the ages of 15-65 for males.
- Unemployment rate between the ages of 15-65 for females.
- Unemployment rate between the ages of 15-65 for the entire population.

In our study, GDP, Employment rate, Unemployment rate and inflation rate are in percentages and these rates in the data are based on the International Labour Organization (ILO) estimates modelled on national basis.

### *Methodologies*

Since our study deals with panel data over 15 years across 12 different countries, naturally we need to consider the issue of individual heterogeneity. There are different ways to account for individual heterogeneity. One commonly used method is standard fixed-effect panel regression model which allows for the heterogeneous intercepts and another is the least square dummy variable (LSDV) regression model by introducing dummy variables to account for the individuality among different countries. Both methods are able to capture the individuality whereas the former has the advantage of not losing too many degrees while the latter is able to display all individual intercepts for different countries. The main issue of using LSDV is that when the sample size is small introducing many dummy variables would end up losing significant number of degrees of freedom. However, this is not our concern as our sample size is relatively large. Therefore in this study we begin by fitting a Pooled Ordinary Least Square (OLS) regression model treating it as a benchmark then adopt the LSDV method to take into account country heterogeneity.

In Pooled OLS and LSDV models, we include Empl15/24Male, Empl15/24Female and Empl15/24Total, Empl15/65Male, Empl15/65Female and Empl15/65Total as regressors; and similarly Unempl15/24Male, Unempl15/24Female and Unempl15/24Total, Unempl15/65Male, Unempl15/65Female and Unempl15/65Total are all included in the second set of Pooled OLS and LSDV, consequently there may exist serious multicollinearity



issue. To avoid multicollinearity problem, we re-run pooled OLS and LSDV with only Empl15/24Total, Empl15/65Total and inflation rate as the regressors.

### *Pooled ordinary least square (OLS)*

Assuming individual effect  $\mu_i$  (time specific effect) does not exist ( $\mu_i = 0$ ), i.e. there does not exist country heterogeneity, then the pooled OLS produces efficient and consistent estimates.

$$\begin{aligned} GDP &= \beta_0 + \beta_1 Empl15/24 M + \beta_2 Empl15/24 F + \beta_3 Empl15/24 T \\ &\quad + \beta_4 Empl15/65 M + \beta_5 Empl15/65 F + \beta_6 Empl15/65 M + \varepsilon \\ GDP &= \beta_0 + \beta_1 Unempl15/24 M + \beta_2 Unempl15/24 F + \beta_3 Unempl15/24 T \\ &\quad + \beta_4 Unempl15/65 M + \beta_5 Unempl15/65 F + \beta_6 Unempl15/65 M \\ &\quad + \varepsilon \end{aligned}$$

### *Least square dummy variable (LSDV)*

Assuming there exists country heterogeneity, we construct a LSDV model with GDP as the dependent variable and employment rate as independent variables, 11 dummy variables are introduced in the regression to allow for country heterogeneity treating Equatorial Guinea as the benchmark:

$$\begin{aligned} GDP &= \beta_0 + \beta_1 Empl15/24 M + \beta_2 Empl15/24 F + \beta_3 Empl15/24 T \\ &\quad + \beta_4 Empl15/65 M + \beta_5 Empl15/65 F + \beta_6 Empl15/65 M + \mu_1 g_1 \\ &\quad + \mu_2 g_2 + \mu_3 g_3 + \mu_4 g_4 + \mu_5 g_5 + \mu_6 g_6 + \mu_7 g_7 + \mu_8 g_8 + \mu_9 g_9 \\ &\quad + \mu_{10} g_{10} + \mu_{11} g_{11} + \varepsilon \end{aligned}$$

Similarly an LSDV model using unemployment rate as independent variables is constructed as:

$$\begin{aligned} GDP &= \beta_0 + \beta_1 Unempl15/24 M + \beta_2 Unempl15/24 F + \beta_3 Unempl15/24 T \\ &\quad + \beta_4 Unempl15/65 M + \beta_5 Unempl15/65 F + \beta_6 Unempl15/65 M \\ &\quad + \mu_1 g_1 + \mu_2 g_2 + \mu_3 g_3 + \mu_4 g_4 + \mu_5 g_5 + \mu_6 g_6 + \mu_7 g_7 + \mu_8 g_8 \\ &\quad + \mu_9 g_9 + \mu_{10} g_{10} + \mu_{11} g_{11} + \varepsilon \end{aligned}$$

- $\beta_0$  is the intercept. The intercept represent the average annual percentage change in GDP growth given that there are no regressors in the model and no dummies also.
- $\beta_1$  is the slope of employment and unemployment for males from age 15 to age 24. It represent the expected change in annual percentage change in GDP growth per percentage change in employment and unemployment rate for males between the ages of 15 and 24 given that other regressors are constant including all dummies in the model.
- $\beta_2$  is the slope of employment and unemployment for females from age 15 to age 24. It represent the expected change in annual GDP growth rate per percentage change in employment and unemployment rate for females between the ages of 15 and 24 given that all other regressors are constant including all dummies in the model.

- $\beta_3$  is the slope of employment and unemployment for the entire youth population. It represent the expected change in annual percentage change in GDP growth per percentage change in employment and unemployment rate for both males and females between the ages of 15 and 24 given that all other regressors are constant including all dummies in the model.
- $\beta_4$  is the slope of employment and unemployment for males from age 15 to age 65. It represent the expected change in GDP growth (annual %) per percentage change in employment and unemployment rate for both males between the ages of 15 and 65 given that all other regressors are constant including all dummies in the model.
- $\beta_5$  is the slope of employment and unemployment rate for females from age 15 to age 65. It represent the expected change in annual percentage change in GDP growth per percentage change in employment and unemployment rate for both females between the ages of 15 and 65 given that all other regressors are constant including all dummies in the model.
- $\beta_6$  is the slope of employment and unemployment for the population in total. It represent the expected change in annual percentage change in GDP growth per percentage change in employment and unemployment rate for the entire labour force between the ages of 15 and 64 given that all other regressors are constant including all dummies in the model.

A negative/positive value of  $\beta_1, \beta_2, \dots, \beta_6$  shows that GDP growth rate would decrease/increase by  $\beta_1, \beta_2, \dots, \beta_6$  if the corresponding regressor (employment and unemployment rate for the various dimensions) increases by one percentage unit; on the other hand,  $g_1, g_2, \dots, g_{11}$  are the dummy variable created representing Gabon, Ethiopia, Uganda, Zambia, Zimbabwe, Botswana, Namibia, Cote d'Ivoire, Gambia, Ghana and Nigeria respectively treating Equatorial Guinea as a benchmark and  $\mu_1, \mu_2, \dots, \mu_{11}$  are parameters (mean GDP growth rate) of the dummies.  $\mu_1 g_1$  for instance, is the difference of real impact of GDP growth rate between Equatorial Guinea and Uganda.

## Analysis

### *Descriptive statistics*

Table 1 reports the descriptive statistics of all variables. An average annual percentage change in GDP growth is 5.481953% with a standard deviation of 7.567125%. It recorded a minimum of -17.66895% and a maximum of 63.37988% over the years under study. The average employment rate for the female population, male population and entire population were 60.08556%, 72.19722% and 66.16278% respectively. However, the female youth (15-24) years, on average over the years under study recorded employment rate of 43.86889% whilst male youth aged 15-24 years have an average employment rate of 51.04111% and the total youth population with an average employment rate of 47.47222. On the other hand, the average unemployment rate for the male youth population, female youth population and the youth population in general were 16.40333%,

19.15667% and 17.70833% respectively with corresponding standard deviation of 11.6892%, 14.64537% and 12.91049%. Also, the entire population which comprises of the youth and the adult population had an unemployment rate of 10.17% on the average whilst total female population and male population recorded an average unemployment rate of 11.32% and 9.15% respectively. The mean inflation rate is 8.3% with 18.11% standard deviation.

Table 1: Descriptive analysis of the variables under study.

Variables under study	Mean	Standard deviation	Minimum	Maximum
GDP growth annual	5.481953	7.567125	-17.66895	63.37988
EMPL15+ Female	60.08556	13.24425	33.3	79.6
EMPL15+ Male	72.19722	11.50599	46.7	88.4
EMPL15+ Total	66.16278	11.95924	39.7	83
EMPL15-24 Female	43.86889	17.56093	13.3	72.1
EMPL15-24 Male	51.04111	19.30661	18.4	80.3
EMPL15-24 Total	47.47222	18.11474	15.8	75
UNEMPL15+ Female	11.32	8.391259	1.8	43.2
UNEMPL15+ Male	9.145555	6.111801	1.7	32.4
UNEMPL15+ Total	10.17	6.967137	1.8	37.6
UNEMPL15-24 Female	19.15667	14.64537	1.8	64.7
UNEMPL15-24 Male	16.40333	11.6892	2	55.4
UNEMPL15-24 Total	17.70833	12.91049	1.9	59.9
Inflation rate	8.307388	18.11474	-8.237845	57.16525

Figure 1 performs proximate analysis of average annual percentage change in GDP growth rate over the years to study the trend of this variable.

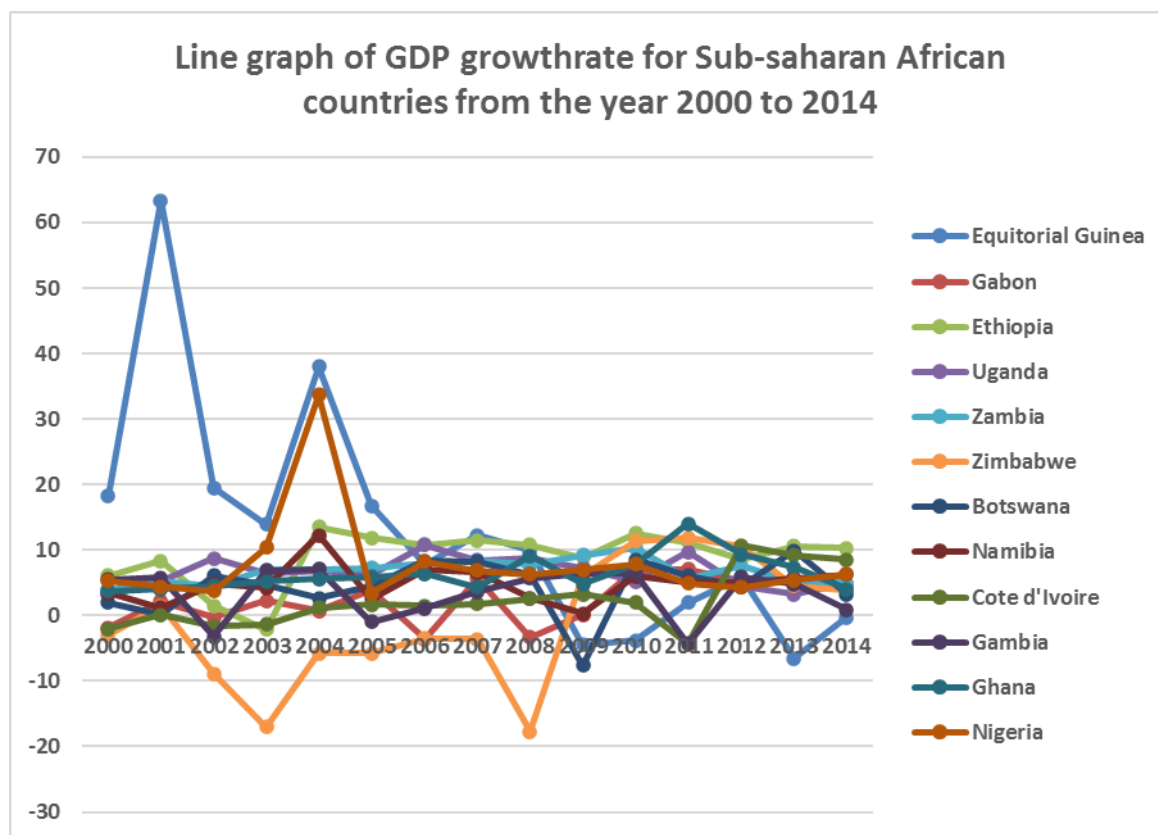
*Trend analysis of annual percentage change in GDP growth rate*

Figure 1: Trend analysis of annual percentage change in GDP growth rate overtime from 2000 to 2014

It can be inferred from the graph above that, Equatorial Guinea recorded the highest rate of annual percentage change in GDP growth among the selected countries in the sub-Saharan region over the years under study. i.e. a growth rate above 60% in the year 2001. During the following year (2002), its annual percentage change in GDP growth rate reduced to about 19% and further dropped to 12% in 2003. In the same periods, the annual percentage change in GDP growth rate of the other countries are seen fluctuating between -10% and 10%.

Zimbabwe recorded the lowest growth in annual percentage change in GDP in the year 2008 of about - 18.7% throughout the fifteen year range from 2000 to 2014; among all the selected countries understudy. However, a rise in annual percentage change in GDP growth rate of Zimbabwe was recorded between 0% and 15% from the years 2008 and 2014.

Another country with a competitive economic status is Nigeria. Nigeria has since the year 2000 experienced increased rates of growth from 4.28% in 2000. The annual percentage change in GDP growth rate of Nigeria was seen stabilized through the years from 2000 to 2002. The rate shoots up to 10% in 2003 and rose to compete the highest growing economy at that time, Equatorial Guinea, in 2004 where annual percentage change in GDP growth rate for Nigeria was about 33% compared to that of Equatorial Guinea (38%).

Over the fifteen year range from 2000 to 2014, the other countries of the Sub region (Gabon, Ethiopia, Uganda Zambia, Botswana, Namibia, Cote d'Ivoire,

Gambia and Ghana) have recorded annual percentage change in GDP growth rates fluctuating between -7.08% and 12%.

In Figures 2/3, box plots are used to identify the year and country that recorded the lowest and highest annual percentage change in GDP.

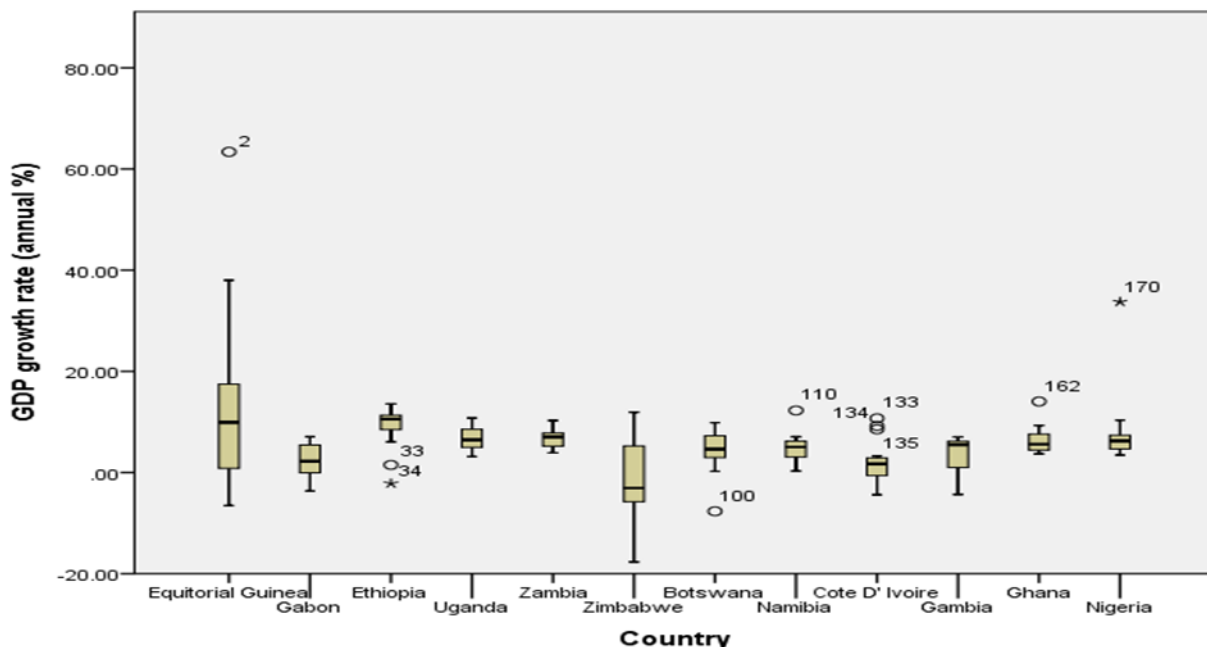


Figure 2: Box plot of GDP growth rates among 12 countries

Figure 2 above shows the distribution of annual percentage change in GDP growth rate. From the pictorial view of the diagram above, we can see that Equatorial Guinea recorded the highest over the years under study whilst Zimbabwe recorded the lowest.

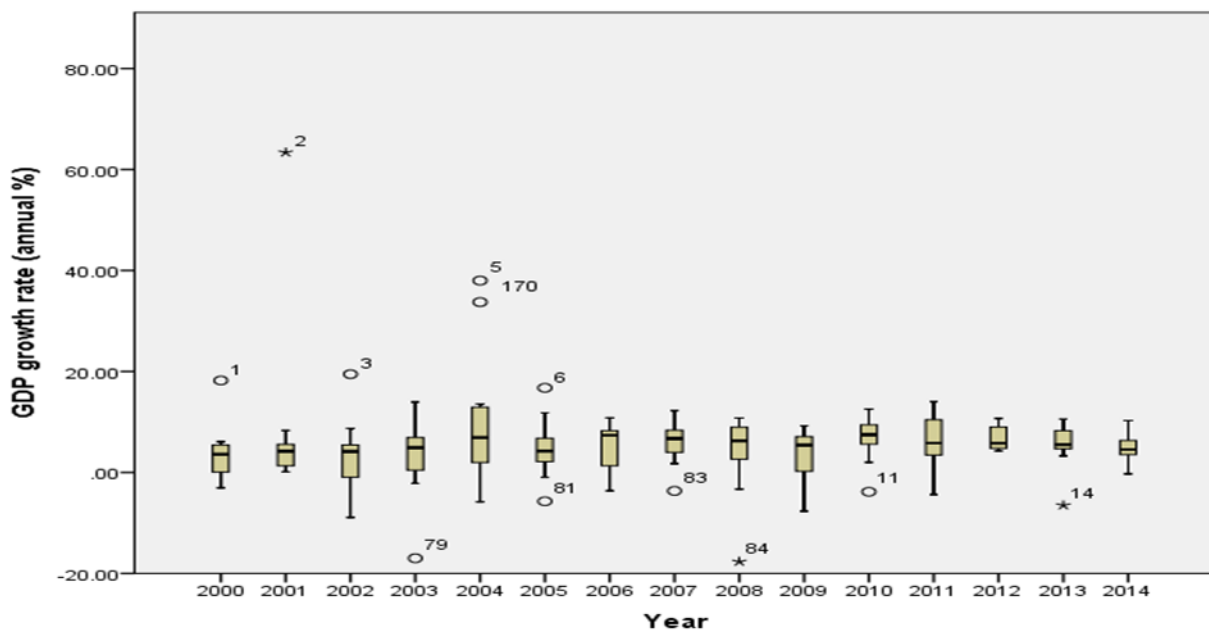


Figure 3: Box plot of GDP growth rates during 2000 to 2014

From Figure 3 above, we find the highest annual percentage change in GDP growth rate recorded by Equatorial Guinea occurred in the year 2001 and the lowest rate recorded by Zimbabwe was in the year 2008.

### *The Pooled OLS regression model for employment rate.*

Table 2 presents the pooled OLS results for employment rate. The expected annual percentage change in GDP growth rate if employment rate for the youth and the population in general are zero is 12.71185%. The results suggest a positive relationship between annual percentage change in GDP growth and employment for the female population (Empl15+Female), employment rate for the male population (Empl15+Male) and employment rate for the Total Youth population (Empl15-24 total) (Objective one and three). Employment rate for the male and female as well as the entire youth population was tested to be statistically significant at 5% alpha level with p-values of 0.008, 0.010 and 0.009 respectively in the model. Overall, the model is statistically significant at 1% level. However it is noticed that the R-squared value is 0.1 indicating that only around 10% variation in the dependent variable can be explained by the independent variables, suggesting the employment rates including youth and total population do not play an important role in explaining the GDP growth rate.

Table 2: The Pooled OLS regression model for employment rate.

Variables	Coefficient	t-statistic	<b>P &gt;  t </b>
EMPL15+ Female	2.547462 (2.169222)	1.17	0.242
EMPL15+ Male	1.832882 (2.363584)	0.78	0.439
EMPL15+ Total	-4.550058 (4.421354)	- 1.03	0.305
EMPL15-24 Female	-18.54731 (6.859466)	-2.70	0.008***
EMPL15-24 Male	-17.9669 (6.911241)	-2.60	0.010**
EMPL15-24 Total	36.63448 (13.7635)	2.66	0.009***
_Cons	12.71185 (11.36206)	1.12	0.265

\*Significant p-value = 0.0052\*\*\* R<sup>2</sup>=0.1001 Adj R<sup>2</sup>=0.0689

\*\*significant p<0.1 \*\*\*significant p<0.05 \*\*\*significant p<0.01

### *The Pooled Ordinary Least Square (OLS) regression model for unemployment rate.*

Table 3 reports the pooled OLS results for unemployment rate. With no unemployment rate in Sub Sahara Africa, the estimated annual percentage change in GDP growth rate is approximately 5.8%. An inverse relationship exists between annual percentage change in GDP growth rate and male population, female population, male youth population and total youth population

but a positive relationship between annual percentage change in GDP growth rate and entire population in general, and female youth population. All estimates are statistically significant for entire population and intercept but insignificant for the various youth classification (male youth, female youth and entire youth population). Overall model was statistically significant only at 10% level of significance. Also, only a smaller variability, 6.49%, in the annual percentage change in GDP growth rate was explained by unemployment.

Table 3: The Pooled Ordinary Least Square (OLS) regression model for unemployment rate.

Variables	Coefficient	t-statistic	$P >  t $
UNEMPL15+ Female	-15.45666 (5.563785)	-2.78	0.006***
UNEMPL15+ Male	-17.3152 (6.422303)	-2.70	0.008***
UNEMPL15+ Total	33.08734 (11.95659)	2.77	0.006***
UNEMPL15-24 Female	.2800333 (4.10162)	0.07	0.946
UNEMPL15-24 Male	-0.0007108 (4.236167)	-0.00	1.000
UNEMPL15-24 total	-.5020503 (8.409338)	-0.06	0.952
_Cons	5.847807 (1.097684)	5.33	0.000***
*Significant	p-value = 0.0681*	R <sup>2</sup> =0.0649	Adj R <sup>2</sup> =0.0324
*significant p<0.1	**significant p<0.05	***significant p<0.01	

### *Least Square Dummy Variable (LSDV) regression model for employment rate.*

Table 4 presents LSDV results for employment rate. The signs of coefficients for the employment rates are consistent with those applying the Pooled OLS procedure. Given that the employment rate for both the youth and the population in general is zero, the estimated annual percentage change in GDP growth rate Equatorial Guinea is approximately -8.79%. There exists a positive relationship between male and female population in general as well as the entire youth population but an inverse relationship between the entire populations (Empl15+Total), male and female youth population and the annual percentage change in GDP growth. The overall model however tested to be statistically significant. And the value of R-squared increases significantly in LSDV estimation. It is also worth noting that the p-values for almost all dummy variables are insignificant even at 10% level, suggesting no significant heterogeneity among the 12 countries.

However, after controlling for random effects in the model, the coefficients of the dummies decreased (Table 3.1) (objective 3). Overall model was statistically significant even at 1% level of significance. However, only 1.688% of the total variability in annual percentage change in GDP growth rate was explained for by employment. (Adj R-square), again suggesting that the employment rates do not play an important role in explaining the GDP growth rate.

Table 4: Least Square Dummy Variable (LSDV) regression model for employment rate.

Variables	LSDV without random effect		LSDV with control for random effect	
	Coefficient	$P >  t $	Coefficient	$P >  t $
1. Equatorial Guinea	13.20902 (17.01864)	0.439	10.02653 (16.05039)	0.532
2. Gabon	-2.121104 (3.757521)	0.573	-5.303585 (4.696615)	0.259
3. Ethiopia	1.012205 (13.59983)	0.941	-2.170276 (11.52078)	0.851
4. Uganda	-10.18167 (9.976444)	0.309	-13.36415 (8.777063)	0.128
5. Zambia	-6.018589 (7.856835)	0.445	-9.201071 (6.286893)	0.143
6. Zimbabwe	-14.38116 (12.13236)	0.238	-17.56364 (10.5491)	0.096*
7. Botswana	-0.7270353 (6.167348)	0.906	-3.909517 (5.473285)	0.475
8. Namibia	Omitted		-3.182481 (4.980836)	0.523
9. Cote d'Ivoire	9.323688 (12.91276)	0.471	6.141207 (10.13418)	0.545
10. Gambia, The	-10.03933 (9.95175)	0.315	-13.22181 (8.117874)	0.103
11. Ghana	-7.674542 (7.027077)	0.276	-10.85702 (7.257061)	0.135
12. Nigeria	3.182481 (4.980836)	0.524		
EMPL15+ Female	4.129792 (4.210858)	0.328		
EMPL15+ Male	3.977466 (4.593156)	0.388		
EMPL15+ Total	-7.703282 (8.671282)	0.376		
EMPL15-24 Female	-6.294273 (7.618074)	0.410		
EMPL15-24 Male	-7.747439 (7.442001)	0.299		
EMPL15-24 Total	13.94997 (15.0125)	0.354		
_ Cons	-8.791047 (23.1155)	0.704		

\*Significant

\*significant  $p < 0.1$ 

p-value = 0.0001\*\*\*

\*\*significant  $p < 0.05$  $R^2 = 0.2477$ \*\*\*significant  $p < 0.01$ Adj  $R^2 = 0.01688$



*Least Square Dummy Variable (LSDV) regression model for unemployment rate.*

Table 5 reports LSDV estimates for unemployment rate. Given that the unemployment rate for both the youth and the population in general is zero, the estimated annual percentage change in GDP growth Equatorial Guinea is approximately 14.98%. There exists an inverse relationship between male (Unempl15+Male) and female population in (Unempl15+Female) as well as male youth population (Unempl15-24Male) and female youth population (Unempl15-24Female). All other variables tested to have a positive relationship. The results suggest significant heterogeneity among some countries but not all of them. Again, on the other hand, the coefficients of the dummies increased after controlling for random effects in the model (Objective 3). After adjusting degrees of freedom, around 29.4% variation in the dependent variable can be explained by the independent variables.

Table 5: Least Square Dummy Variable (LSDV) regression model for unemployment rate.

Variables	LSDV without random effect		LSDV with control for random effect	
	Coefficient	$P >  t $	Coefficient	$P >  t $
1. Equatorial Guinea	4.951837 (4.684412)	0.292	8.565673 (2.665973)	0.001***
2. Gabon	22.57175 (9.086339)	0.014**	26.18559 (7.903887)	0.001***
3. Ethiopia	3.357025 (7.211166)	0.642	6.970861 (4.376725)	0.111
4. Uganda	-6.642482 (5.789697)	0.253	-3.028646 (2.988115)	0.311
5. Zambia	Omitted		3.613836 (4.163018)	0.385
6. Zimbabwe	-12.30394 (4.736389)	0.010**	-8.690103 (2.493136)	0.000***
7. Botswana	11.1137 (5.696878)	0.053	14.72754 (5.500081)	0.007***
8. Namibia	14.41448 (5.489562)	0.009***	18.02831 (6.267208)	0.004***
9. Cote d'Ivoire	-16.73929 (5.438418)	0.002***	-13.12545 (2.927954)	0.000***
10. Gambia, The	-7.641181 (4.980168)	0.127	-4.027345 (2.671703)	0.132
11. Ghana	-5.268208 (5.039536)	0.297	-1.654372 (2.689777)	0.539
12. Nigeria	-3.613836 (4.163018)	0.387	Omitted	
UNEMPL15+ Female	-16.50123 (5.11249)	0.002***		
UNEMPL15+ Male	-18.62116 (5.78243)	0.002***		
UNEMPL15+ Total	34.67644 (10.73235)	0.001***		

UNEMPL15-24 Female	-19.19291 (4.573585)	0.000***
UNEMPL15-24 Male	-19.5576 (5.052659)	0.000***
UNEMPL15-24 total	38.57335 (9.583057)	0.000***
_Cons	14.97961 (6.077654)	0.015***
*Significant p-value =0.0000    R <sup>2</sup> =0.3613    Adj R <sup>2</sup> =0.2942		
*significant p<0.1       **significant p<0.05       ***significant p<0.01		

*Comparison between pooled OLS and LSDV regression model for both employment and unemployment rate*

Table 6: Comparison between pooled OLS and LSDV regression model for both employment and unemployment rate

Variables	Employment		Unemployment	
	Pooled OLS	LSDV Regression Model	Pooled OLS	LSDV Regression Model
Number of observations	180	180	180	100
F( n, N)	3.21	3.14	2.00	5.39
Prob > F	0.0052***	0.0001***	0.0681*	0.0000***
R-squared	0.1001	0.2477	0.0649	0.3613
Adj R-squared	0.0689	0.1688	0.0324	0.2942
Root MSE	7.3016	6.899	7.4433	6.3571

\*significant p<0.1    \*\*significant p<0.05    \*\*\*significant p<0.01

Comparatively, both the pooled OLS and the LSDV regression model for employment tested to be statistically significant but a greater variability in the LSDV was explained by its explanatory variables (16.88%) than that of the pooled OLS (6.89%)

On the other hand, comparing the pooled OLS and the LSDV regression model for unemployment rate, the pooled OLS was not statistically significant at 5% alpha level. The LSDV regression model for unemployment however tested to be statistically significant. Again, greater variability in the LSDV regression mode was explained by its regressors (29.42%) than the pooled OLS (3.42%).

*Inter country analysis*

Table 7: Inter-country analysis

Country	Employment	$P >  t $	Unemployment	$P >  t $
	Coefficient		Coefficient	
1. Equatorial Guinea	4.417973	0.439	19.931447	0.292
2. Gabon	-10.912151	0.573	37.55136	0.014**
3. Ethiopia	-7.778842	0.941	18.336635	0.642
4. Uganda	-18.972717	0.309	8.337128	0.253
5. Zambia	-14.809636	0.445	Omitted	-
6. Zimbabwe	-23.172207	0.238	2.67567	0.010**
7. Botswana	-9.5180823	0.906	26.09331	0.053*
8. Namibia	Omitted	-	29.39409	0.009***
9. Cote d'Ivoire	0.532641	0.471	-1.75968	0.002***
10. Gambia, The	-18.830377	0.315	7.338429	0.127
11. Ghana	-16.465589	0.276	9.711402	0.297
12. Nigeria	-5.608566	0.524	11.365774	0.387

\*significant  $p < 0.1$ \*\*significant  $p < 0.05$ \*\*\*significant  $p < 0.01$ 

Comparatively, given that there is no employment in Sub-Saharan Africa, Equatorial Guinea recorded the highest expected growth rate of 4.417973%. This was followed by Cote d'Ivoire with an expected annual percentage change in GDP growth of 0.532641% with Zimbabwe recording the lowest expected annual percentage change in GDP growth of -23.172207%. The Equatorial Guinea economy is more stable with Zimbabwe being the least stable.

Also given that there is no unemployment among Sub-Saharan Africa countries, Namibia recorded the highest expected annual percentage change in GDP growth of 29.39409%. This is followed by Botswana with an expected annual percentage change in GDP growth of 26.09331% and Cote d'Ivoire recording the least expected annual percentage change in GDP growth of -1.75968%. The economy with most stable in this case is Namibia (29.39409%) (Objective 2).

As discussed earlier in this study, there may exist serious multicollinearity in both Pooled OLS and LSDV models. The calculated correlation coefficients between each two independent variables confirmed that high multicollinearities (above 80%) do exist among most variables. In addition, the low R-squared values suggest both employment/unemployment do not play important roles explaining the GDP growth and we need to include other potential regressors in both model. The commonly used regressors explaining the GDP growth rate are inflation rate and interest rate. However, due to the data limitation we are not able to obtain enough observations for interest rate. Under this circumstance, we re-run the Pooled OLS and LSDV with only total employment/unemployment and inflation rates as the regressors.

Tables 8/9 reports the Pooled OLS results for employment/unemployment rates as well as inflation rate. Clearly neither employment/unemployment nor inflation rate significantly affect the GDP growth rate in Sub-Saharan Africa. The model is insignificant overall and the extremely low value of R-squared all indicate these regressors do not explain the GDP growth rate.

Employment, unemployment and inflation on annual percentage change in GDP growth rate.

The Pooled OLS regression model for employment/unemployment rate.

Table 8: The Pooled OLS regression model for employment rate.

Variables	Coefficient	t-statistic	<b>P &gt;  t </b>
EMPL15+	0.1244307 (0.1885617)	0.66	0.510
EMPL15-24	-0.034727 (0.1244595)	-0.28	0.781
Inflation rate	-0.0821564 (0.0712619)	-1.15	0.251
_Cons	-0.4196553 (6.910971)	-0.06	0.952
*Significant	p-value = 0.2979	R <sup>2</sup> =0.0206	Adj R <sup>2</sup> =0.0040
*significant p<0.1	**significant p<0.05	***significant p<0.01	

The Pooled OLS regression model for unemployment rate.

Table 9 : The OLS regression model for unemployment rate

Variables	Coefficient	t-statistic	<b>P &gt;  t </b>
UNEMPL15+	0.2815056 (0.4801842)	0.59	0.558
UNEMPL15-24	-0.2139392 (0.2595843)	-0.82	0.411
Inflation rate	-0.0930192 (0.0717086)	-1.30	0.196
_Cons	7.180294 (1.207268)	5.95	0.000***
*Significant	p-value = 0.3029	R <sup>2</sup> = 0.0204	Adj R <sup>2</sup> = 0.0037
*significant p<0.1	**significant p<0.05	***significant p<0.01	

Tables 10/11 show LSDV results for employment/unemployment rates besides inflation rate. Mostly the signs of the coefficients for the three variables are consistent with those in Pooled OLS regression. Again none of the regressors significantly affect the GDP growth rate. And there do not exist significant heterogeneity among most countries.

*Least Square Dummy Variable (LSDV) regression model for employment rate*

Table 10: Least Square Dummy Variable (LSDV) regression model for employment rate

Variable	LSDV without random effect		LSDV with random effect	
	Coefficient	<b>P &gt;  t </b>	Coefficient	<b>P &gt;  t </b>
Equatorial Guinea	-7.422085 (10.02635)	0.46	-7.422085 (10.02635)	0.459
Gabon	-4.353324 (4.604284)	0.346	-4.353324 (4.604284)	0.344
Ethiopia	-10.9975 (9.752727)	0.261	-10.9975 (9.752727)	0.259
Uganda	-11.15226 (8.718074)	0.203	-11.15226 (8.718074)	0.201
Zambia	-8.834323 (6.066111)	0.147	-8.834323 (6.066111)	0.145
Zimbabwe	-21.30041 (9.885448)	0.033**	-21.30041 (9.885448)	0.031**
Botswana	-6.48273 (4.381837)	0.141	-6.48273 (4.381837)	0.139
Namibia	-1.440435 (3.746929)	0.701	-1.440435 (3.746929)	0.701
Cote d'Ivoire	-10.82189 (5.028501)	0.033**	-10.82189 (5.028501)	0.031**
Gambia, The	-13.24772 (7.245976)	0.069*	-13.24772 (7.245976)	0.068*
Ghana	-6.863217 (6.924541)	0.323	-6.863217 (6.924541)	0.322
Nigeria	Omitted		Omitted	
EMPL 15+	0.3762769 (0.5181205)	0.469		
EMPL 15-24	0.0314073 (0.3407857)	0.927		
Inflation	-0.1071483 (0.0788949)	0.176		
_Cons	-11.4381 (19.72886)	0.563		
*Significant	p-value = 0.0000***	R <sup>2</sup> =0.2305	Adj R <sup>2</sup> =0.01652	
*significant p<0.1	**significant p<0.05	***significant p<0.01		

*Least Square Dummy Variable (LSDV) regression model for unemployment rate*

Table 11: Least Square Dummy Variable (LSDV) regression model for unemployment rate

Variable	LSDV without random effect		LSDV with random effect	
	Coefficient	<b>P &gt;  t </b>	Coefficient	<b>P &gt;  t </b>
Equatorial Guinea	6.625915 (2.749604)	0.017**	3.644392 (2.665334)	0.172
Gabon	2.321454 (6.503585)	0.722	-0.660068 (5.10875)	0.897
Ethiopia	1.733539 (2.6991)	0.522	-1.247984 (2.859607)	0.663
Uganda	Omitted		-2.981522 (2.965185)	0.315
Zambia	4.1475 (4.75339)	0.384	1.165978 (3.533668)	0.741
Zimbabwe	-7.465771 (2.666391)	0.006***	-10.44729 (2.661983)	0.000***
Botswana	5.335626 (5.94231)	0.371	2.354103 (4.622496)	0.611
Namibia	7.468862 (7.6596)	0.331	4.48734 (6.220106)	0.471

Cote d'Ivoire	-4.623106 (2.543357)	0.071*	-7.604628 (2.982242)	0.011**
Gambia, The	-2.829733 (2.79591)	0.313	-5.811255 (2.674772)	0.03**
Ghana	0.9302182 (2.609481)	0.722	-2.051304 (2.696175)	0.447
Nigeria	2.981522 (2.965185)	0.316	Omitted	
UNEMPL 15+	0.3241279 (0.5457262)	0.553		
UNEMPL 15-24	-0.438582 (0.3705118)	0.238		
Inflation	-0.1070382 (0.0788837)	0.177		
_Cons	9.455833 (2.227977)	0.000***		

\*Significant p-value = 0.0000\*\*\* R<sup>2</sup>=0.2326 Adj R<sup>2</sup>=0.1675  
 \*significant p<0.1 \*\*significant p<0.05 \*\*\*significant p<0.01

*Comparison between pooled OLS and LSDV regression model for both employment and unemployment rate after*

Table 12 shows result comparison between the two estimation procedures. It is noticed that LSDV method does improve the significance of the model but the R-square and adjusted R-squared values are still very low using this method. Overall we conclude employment/unemployment rates as well as inflation rate do not significantly explain the GDP growth rate and other potential regressors should be considered when investigating the effect on the GDP growth rate.

Table 12: Comparison between pooled OLS and LSDV regression model for both employment and unemployment rate

Variables	Employment		Unemployment	
	Pooled OLS	LSDV Regression Model	Pooled OLS	LSDV Regression Model
Number of observations	180	180	180	180
F(n, N)	1.24	3.53	1.22	3.57
Prob > F	0.2979	0.0000***	0.3029	0.0000***
R-squared	0.0206	0.2305	0.0204	0.2326
Adj R-squared	0.0040	0.1652	0.0037	0.1675
Root MSE	7.5522	6.914	7.553	6.9043

\*significant p<0.1 \*\*significant p<0.05 \*\*\*significant p<0.01

*Inter country analysis after including inflation*

Table 13: Inter-country analysis

Country	Employment Coefficient	<b><i>P</i> &gt;  <i>t</i> </b>	Unemployment Coefficient	<b><i>P</i> &gt;  <i>t</i> </b>
1. Equatorial Guinea	-18.860185	0.46	16.081748	0.017**
2. Gabon	-15.791424	0.346	11.777287	0.722
3. Ethiopia	-22.4356	0.261	11.189372	0.522
4. Uganda	-22.59036	0.203	Omitted	
5. Zambia	-20.272423	0.147	13.603333	0.384
6. Zimbabwe	-32.73851	0.033**	1.990062	0.006***
7. Botswana	-17.92083	0.141	14.791459	0.371
8. Namibia	-12.878535	0.701	16.924695	0.331
9. Cote d'Ivoire	-22.25999	0.033**	4.832727	0.071*
10. Gambia, The	-24.68582	0.069*	6.6261	0.313
11. Ghana	-18.301317	0.323	10.3860512	0.722
12. Nigeria	Omitted		12.437355	0.316

\*significant p&lt;0.1

\*\*significant p&lt;0.05

\*\*\*significant p&lt;0.01

## Discussion

Issues of employment and unemployment in Africa are critical factors that affect the wellbeing of people. Whereas employment improves socio-economic well-being of individuals globally, unemployment and joblessness despite its psychological effects in one way or the other lead to social vices which have negative impact on society and the economy. Looking at employment in Sub-Saharan Africa according to the study, only about two-thirds were working overtime from the years 2000 to 2014 (Table 1). The question remains what about the remaining one-third. Unemployment seems to be higher amongst the youth in Africa (Table 2). A recent ILO report indicated that despite the higher rate of unemployment and vulnerable employment increasing, Africa still face challenges in terms of job creation and sustainability. Thus, if it persists to increase will cause drastic effect on the African continent. Youth unemployment is vital in every economy due to the significant effect it has on the socio-economic well-being of individuals in Africa and the world at large. An increase in youth employment reduces dependency burden as they can support themselves and family.

The causal relationship between annual percentage change in GDP growth rate and employment has mixed effect. A positive causal relationship was expected across all sub-divisions of employment, but some employment groups expressed a negative causal effect. However, for the countries in Sub-Saharan Africa to increase annual percentage change in GDP growth rate, they should increase employment in female population, male population as well as entire youth population irrespective of sex. The impact is most effective amongst the entire youth populace. A unit increase in employment amongst the youth leads to a 36.63% increase in annual percentage change in GDP growth rate. This impact is statistically significant. OLS results of unemployment on annual percentage change in GDP growth rate exhibited mixed effect as well. The relationship between annual percentage change in GDP growth rate and unemployment for female population, male population as well as male youth population confirms

Okun's law; a negative relationship between unemployment and output growth as expected. On comparing the individual Sub-Saharan, Equatorial Guinea and Cote d'Ivoire are the most stable looking at the impact of employment on annual percentage change in GDP growth. However, that is not the case for unemployment on annual percentage change in GDP growth. When unemployment is zero in the model, Gabon, Namibia and Botswana seems to be topping the charts. This implies that given full employment in Sub-Saharan Africa, these countries will increase growth more than any another country in the region amongst the countries under study. Gabon in recent times is considered one of the growing economies in Africa. Policies in Gabon seem to enhance growth, creating employment and reducing inflation. This is attributed to their Economic Recovery Plan for 2017-2020 as a result of the slump in hydrocarbon prices in 2014. Conscious efforts due to the plan is contributing immensely towards their economic growth. Namibia on the other hand recently have been experiencing fluctuations in terms of grow in GDP but on average, are doing well. Their constant budget deficit in one way or the other have an adverse impact on their economy.

Despite the tremendous positive impacts some countries in the region have in enhancing growth and development, some have had a mild negative impact on annual percentage change in GDP growth. Cote d'Ivoire has mixed effect on assessing the impact of employment and unemployment on GDP growth. Zimbabwe's performance with respect to annual percentage change in GDP growth and employment have been poor. This is due to political instability in the country which does not only influence Zimbabwe but other countries in the region.

Across both Pooled OLS and LSDV regression model, coefficient of determination (R-square) was low. Only a smaller percentage in the model was explained by employment and unemployment. This means that other factors that contribute to annual percentage change in GDP growth rate what was not included in the study. This is the limitation of the study.

## Conclusion

This study investigated the relationship between employment and unemployment on annual percentage change in GDP growth for the youth and the entire population in general. For this purpose, WDI data was used from the period from 2000 to 2014. A sample of 12 Sub-Saharan African countries were randomly selected using a random number of generator and variables taken. Two statistical models were used in the analysis; the Pooled Ordinary Least Square (OLS) regression model and the Least Square Dummy Variable (LSDV) Regression model with fixed effect was used to empirically access impact that employment and unemployment has on annual percentage change in GDP growth. Both the Pooled Ordinary Least Square regression model and the Least Square Dummy Variable regression model tested to be statistically significant but LSDV regression model explained a greater percentage of the variability of the model than the Pooled OLS for employment on annual percentage change in GDP growth. The pooled OLS regression model was not statistically significant at 5% level of significance in assessing the impact that unemployment has on annual percentage change in GDP growth rate but a greater percentage of variation in the annual percentage change in GDP growth rate was explained by



the independent variables in the LSDV than the Pooled OLS. Further empirical analysis of the study also revealed that existed a positive relationship between annual percentage change in GDP growth and employment for the female population (Empl15+Female), employment rate for the male population (Empl15+Male) and employment rate for the Total Youth population (Empl15-24 total) but an inverse relationship between unemployment male youth population (15-24years), and female youth population (15-24years) on annual percentage change in GDP growth. Equatorial Guinea has been the most emerging economy with the highest annual percentage change in GDP growth overtime. Also, they showed the most stable economy in Sub-Saharan Africa whilst Zimbabwe showed the least.

The government of Sub-Saharan African countries must put measures in place to ensure an increase in employment of male and female population in general between the ages of 15-64years. Unemployment between the Male and Female Youth should be reduced due to the immense negative impact that it has on annual percentage change in GDP growth. Economic policy makers in Zimbabwe should structurally transform their economy to improve GDP growth rate of the country

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