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ECONOMIC GROWTH & UNEMPLOYMENT RELATIONSHIP: EVIDENCE FROM SUB-SAHARAN AFRICA.

BY

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INTEGRI PROCEDAMUS

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DECLARATION

I, COSMOS OSEI ATTA JNR, hereby declare that this dissertation is entirely my own work, with the exception of the references to other people's work, which have been appropriately cited, and that neither the entire work nor any portion of it has been submitted for another degree or program elsewhere.

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ABSTRACT

Examining the economic growth-unemployment nexus in Sub-Saharan Africa from 2000 to 2021 was the main objective of the study. The study used both static panel data estimation methodologies (Random effect and fixed effect models) to estimate a balanced panel data. In the study, variables including GDP—a widely used proxy for economic growth—the unemployment rate, FDI, trade openness, inflation, the manufacturing sector, the agricultural sector, and the service sector were all used. AGRIC, MANU, and SERV variables are stationary at first difference, while GDP, UNEMP, FDI, TRADE, and INF variables are stationary at levels. The Granger causality test results showed a unidirectional relationship between unemployment (UNEMP) and gross domestic product (RGDP), with the economic causation running from GDP to UNEMP. The study found out that there is a negative linkage between economic growth and unemployment thus an increase in agricultural production will reduce unemployment in Sub-Saharan Africa, assuming all other variables remain constant. The estimated impact of the service industry on unemployment as a share of GDP is also shown to be positive. There is an inverse link between FDI and unemployment, suggesting that an increase in FDI has an impact on unemployment development. The paper recommends that the government should invest in agricultural modernization and the acquisition of cutting-edge machinery in order to increase participation in agriculture among all segments of the population. High rates of tariff and non-tariff obstacles continue to be a problem for many African countries. Efforts to increase trade should also focus on eliminating these obstacles. Policymakers should devise measures that support and encourage rapid and sustainable economic growth to foster a growth rate that is beneficial to the economy. This study did not estimate other significant variables including labour market institutions (unemployment benefits, employment protection legislation, etc.) due to a lack of data for several SSA nations.

DEDICATION

Every daunting challenge calls for one's own efforts in addition to the counsel of more experienced individuals who played a vital role towards the attainment of this feet. My heartfelt appreciation goes to my loving and supportive parents for their relentless prayers and motivation which has helped me climb this academic ladder and to achieve these great feet. Your unwavering support and care are gratefully acknowledged, and may our Heavenly Father lavish on you His unceasing blessings now and throughout eternity.

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TABLE OF CONTENT

DECLARATION ii
ABSTRACT iii
DEDICATION iv
ACKNOWLEDGEMENT v
LIST OF FIGURES viii
LIST OF TABLES x
LIST OF ABBREVIATIONS AND ACRONYMS xi

CHAPTER ONE 1
INTRODUCTION 1
1.1 Background of the study 1
1.2 Problem Statement 4
1.3 Research Objectives 6
1.4 Research Questions 6
1.5 Significance of the study 7
1.6 Structure of the study 8

CHAPTER TWO 9
REVIEW OF LITERATURE 9
2.0 Introduction 9
2.1 Empirical Review 9
2.2 Theoretical Review 12
2.3 Unemployment theories 13
2.4 Economic Growth theories 14

CHAPTER THREE 16
OVERVIEW OF ECONOMIC GROWTH AND UNEMPLOYMENT IN SUB-SAHARAN AFRICA 16
3.0 Introduction 16
3.02 Unemployment in Sub-Saharan Africa 17
3.1 Economic Growth-Unemployment in Sub-Saharan Africa. 20

3.11 Economic Growth and Unemployment Drivers. 21
3.2 Trend and features of unemployment in Sub-Saharan Africa. 22
3.3 Nature of economic growth in Sub-Saharan Africa 25
3.4 The linkage between economic growth and unemployment 26

CHAPTER FOUR 29
METHODOLOGY AND DATA 29
4.0 Introduction 29
4.1 Model Specification 29
4.4 Source of Data and Variables Description 31
4.2 Panel data Estimation Techniques 34
Test for Over-identifying Restrictions 36
Unit root test 36
Visual Inspection 37
Augmented Dickey Fuller (ADF) Test 37
Phillips-Perron 38
The choice of lag length 39
Johansen cointegration test 40
Vector Error Correction Model 41
VECM granger causality 43
Diagnostic test 43

CHAPTER FIVE 48
PRESENTATION AND DISCUSSION OF RESULTS 48
5.0 Introduction 48
5.1 Descriptive Analysis 48
5.5. Presentation of Empirical Regression Results 53

CHAPTER SIX 60
SUMMARY, CONCLUSION AND POLICY RECOMMENDATION 60
6.1 Introduction 60
6.2 Summary and Conclusion 60

6.3 Policy Recommendations 62
6.4 Limitations of the Study 63

REFERENCES 64
APENDICES 68

LIST OF FIGURES

Figure 3.1: Economic Growth and Unemployment in Sub-Saharan Africa. 20
Figure 3.2: Unemployment Trend in Sub-Saharan Africa. 22
Figure 3.3: Economic Growth Trend in Sub-Saharan Africa 25

LIST OF TABLES

Table 5.1: Summary Statistics……...56

Table 5.5: Pooled OLS Regression……61

Table 5.5.1: Fixed and Random Effects Estimation……..….62

Table 5.6: Hausman Test Results……...63

LIST OF ABBREVIATIONS AND ACRONYMS

ILO	International Labour Organization
GDP	Gross Domestic Product
SSA	Sub-Saharan Africa
ECOWAS	Economic Community of West African States
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
FAO	Food and Agricultural Organization
WESO	World Employment and Social Outlook
ADF	Augmented Dickey-Fuller
AIC	Aikaike's Information Criterion
PV	Probability Value
SIC	Schward Information Criterion
OLS	Ordinary Least Squares
UN	United Nation
HQ	Hannann-Quin Criterion
UNEMP	Unemployment
FDI	Foreign Direct Investment
INF	Inflation

AGRIC	Agriculture
MANU	Manufacturing
SERV	Service
FE	Fixed Effects
RE	Random Effects

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Huge economic and financial problems currently facing the world include, among others, the issue of unemployment and unsustainable economic growth. (Murat, 2014). The reduction of unemployment and attainment of rapid economic growth are the most important economic objectives for both developed and developing countries.

In order to get an accurate view of a nation's economic development, policymakers and the general public regularly monitor economic growth and unemployment, two essential macroeconomic indicators. One of the most prominent relationships in macroeconomic theory has been found to hold true for a variety of nations and regions, mostly in advanced economies rely on these indicators as essential components of their economic policy. (Lee, 2000; Farsio and Quade, 2003; Christopoulos, 2004).

One of the primary questions that economic research aims to investigate is the underlying causes of economic growth. Economic growth is characterized as an increase in real GDP, GDP per capita, or the national product as measured in constant prices, according to Denison (1962). A measure of a country's welfare is economic growth, which quantifies the increase in the volume of goods and services produced there during a specific time period. Carree and Thurik (2000) affirmed that productivity, income distribution, and unemployment are the three aspects of an economy that matter most. According to the International Labour Organization (ILO, 2019), a person is considered unemployed if they are currently without a job, have the necessary skills to obtain a work, and are actively seeking employment. One of the most effective methods for obtaining high economic growth has been to reduce unemployment. This device is especially helpful for

developing nations. As a result, governments can use unemployment as a key macroeconomic tool to shape the way their economy's function.

Unemployment is a multifaceted concept because it impacts both a country's economic activities and the social structure of society. As a result, these two dimensions add complexity to the problems faced by most SSA countries and necessitate substantial analysis to solve it since every policymaker's primary goal, whether fiscal or monetary, is to achieve strong economic growth. Many factors affect the stability of a country's growth rate and notable them is a high unemployment rate. Thus, Okun's Law serves as a theoretical statement that connects economic growth with unemployment which means that if unemployment declines by 1%, GDP also increases by 3%. The primary goal of economic policy is to promote strong economic growth, which leads to increased job demand through investment programs. Therefore, unemployment is a global issue with negative economic and social effects (Al-Habeas et al. 2012).

Okun (1962) empirically showed and confirmed the relationship between growth and unemployment, and it is today recognized as one of the fundamental macroeconomic theories. It establishes the inverse relationship between economic growth and unemployment, which, for the US economy, means that a 1% decline in real production compared to its potential value results in a 0.5% increase in unemployment (Mankiw 2009).

However, different applications of Okun's law have recently surfaced over the globe. In eight Eastern European countries, Soylu et al. (2018) discovered that a 1% increase in GDP growth rate led to a 0.08 percent decrease in the unemployment rate, while Abdul-Khaliq et al. (2014) discovered a 0.16 percent decrease in the unemployment rate in nine Arab countries. These results showed that, despite global geographical variations in the Okun's coefficient, literature consistently demonstrates a causally adverse relationship between GDP growth rate and

unemployment rate. Furthermore, although Okun's coefficients vary somewhat globally, this rule is still applicable in the advanced world economy, according to later well-regarded research (Ball et al. 2019). As a result, Okun's law's rule of thumbs can be used as a benchmark for monitoring the development of long-term economic growth.

Moreover, there is no clear-cut answer to the question of how economic growth and unemployment are related. Numerous findings were reached by researchers after examining unemployment and economic growth. It's been a highly contentious subject from both a theoretical and empirical standpoint. According to theories and earlier studies on the subject, there may be no relationship (Fuad, 2011), a negative relationship (Madito and Khumalo, 2014), or a positive relationship between unemployment and economic growth (Mahmoud, 2012). Once more, there has been debate over whether unemployment can forecast economic growth and vice versa. Granger causality determines whether one indication has any potential predictive power for the other. Unemployment, for instance, granger induces economic growth, which implies that unemployment holds information about future economic growth. Few studies and other pertinent publications also show the divergent viewpoints in the literature on how economic growth affects unemployment. Concerns today extend beyond the straightforward relationship to include the unemployment rate, which could have an effect on economic growth. Given the contentious issues surrounding economic growth and unemployment, the purpose of this paper is to examine the economic growth and unemployment relationships in Sub-Saharan African countries.

1.2 Problem Statement

The majority of countries desire rapid long-term economic growth. However, accomplishing such a goal has proven challenging due to a number of factors that affect economic growth. In addition to other factors, unemployment is one that might be viewed as a significant hindrance to economic growth, hence macroeconomic policy is extremely focused on these two relationships. (Barro, 1998).

When the economy is in equilibrium, factors that support economic growth dynamics in classical economic growth models have no impact on the unemployment rate (the assumption of the full use of the production factors). The factors that affect the unemployment rate, on the other hand, have little consequence on economic growth. The only thing that can cause a short-term negative relationship between the variables is economic instability, especially volatility in the labour market (Gruchelski 2012).

Despite abundant natural and human resources, Sub-Saharan Africa remains one of the world's poorest regions, due to a variety of factors including unpredictable regulatory systems and inadequate infrastructure. Unemployment remains a problem in many of the nations in the area and some SSA governments have made little or no effort to addressing the issue. Once more, a number of macroeconomic factors have been found to affect unemployment generally in the research. However, a more recent theory in the theoretical and empirical literature suggests that economic growth can affect the unemployment rate in a country.

It is important to note that economic growth and unemployment are familiar topics in the areas of finance and economics. As seen by the conflicting results of earlier empirical research on the factors determining unemployment and economic growth, which is still an open question, the relationships between economic growth and unemployment have not yet been resolved or

effectively addressed in the literature. For instance –, Gaber (2018), Maqbool et al (2013), Folawewo and Adeboje (2017), Riaz and Zafar (2018), Baah-Boateng (2014), Baah-Boateng (2016), and Ebaidalla (2016) found that economic growth reduced unemployment, whereas Kerckhoffs et al (1994) and Alrayes and Wadi (2018) found no clear relationship. Previous work has been inconclusive on the direction of causality, whether it is bi-directional or unidirectional (either from unemployment to economic growth or from economic growth to unemployment), or whether there is no relationship between unemployment and economic growth. Such ambiguity on the topic inspired the current study to contribute to the ongoing discussion economic growth and unemployment nexus in an African context.

Also, despite the fact that Africa has high unemployment rates that translate into economic growth and faces similar unemployment issues, most empirical research has avoided looking at the economic growth and unemployment relationships across the continent in general. Single country studies are the foundation of the large majority of empirical research on the causes of unemployment and economic growth in Africa. (Kyei and Gyekye. 2011; Raifu. 2017; Khumalo and Eita. 2015; Baah- Boateng; 2014; Eita and Ashipala. 2010; Baah-Boateng. 2016; Dagume and Gyekye. 2016; Batu. 2016; Fila et al. 2016). Ebaidalla (2016) and Folawewo and Adeboje (2017) undertook some empirical study about the causes of unemployment in the Economic Community of West African States (ECOWAS). Nonetheless, these empirical studies were insufficiently representative of Africa and contained the following methodological flaws: they neglected the fact that unemployment data, and they failed to account for the endogeneity issue and thus this research helps to bridge these gaps.

Finally, rather than simply lumping all sectors together in the form of GDP and studying its impact on unemployment, this study seeks to conduct a disaggregated sectorial analysis on growth to

determine how the components (sectors of the economy) of economic growth (GDP) affect unemployment rates in Sub-Saharan Africa. As a result, this study investigates how value additions in the agricultural, service, and industrial sectors affect the unemployment rate in Sub-Saharan Africa.

1.3 Research Objectives

Investigating the relationship between economic growth and unemployment in Sub-Saharan African economies is the main objective of this study. It uses a disaggregated sectorial approach to investigate the impact of sectorial growth on unemployment in Sub-Saharan Africa. However, to help comprehensively analyze these relationships, the following specific objectives are taken into consideration;

1. To explore the causal relationship between unemployment and economic growth in Sub-Saharan Africa.

2. To examine the impact of growth rate of agriculture, manufacturing and services sectors on unemployment rate in Sub-Saharan Africa.

3. To analyze the impact of economic growth on unemployment in Sub-Saharan Africa.

1.4 Research Questions

To help achieve both the specific and general aims of the study, the following research questions are put forward;

1. What is the link between economic growth and unemployment in Sub-Saharan Africa?

2. What is the impact of growth rate of agriculture, manufacturing and services sectors on unemployment rate in Sub-Saharan Africa?

3. What is the impact of economic growth on unemployment in Sub-Saharan Africa?

1.5 Significance of the study

This study is significant because it seeks to uncover a wealth of evidence on the impact of economic growth on unemployment in Sub-Saharan Africa. Few research has been conducted on the link between economic growth and unemployment, and the results have been inconsistent. Some have found a negative relationship, while others have found a positive one, and only a few have found none. As a result of its empirical examination of SSA, this study will provide more insight into the issue and analyze whether economic growth has a significant impact on unemployment. The region has the fastest growing population, which is accompanied by rising unemployment rates in most countries. This study is important for SSA because it will inform countries about one of the major factors affecting unemployment, allowing them to seek solutions. Governments in SSA countries will be able to implement smart, practical policies that will allow the region to reap the full benefits of economic progress.

Therefore, policymakers, such as various government agencies, will gain from this study in order to create long-term policies and recommendations to combat the issue of unemployment. Furthermore, the study will provide crucial insights into accomplishing the macroeconomic goal of African economies by examining the relationship between unemployment and economic growth.

1.6 Structure of the study

This study has been organized into six separate chapters as follows:

Chapter one introduces the study by covering aspects like the study's background, the problem being researched, questions that the study seeks to answer, objectives to be achieved at the end of the study as well as the importance of the study.

The second chapter contains a review of the literature, which is divided into theoretical and empirical sections. It contains relevant and available literature on the topic investigation from other authors. Theories are also investigated and explained in this chapter.

The third chapter offers an overview of the research in general. It expresses both the framework of unemployment and economic growth. This chapter discusses the links between economic growth and unemployment, as well as their respective determinants.

The fourth chapter examines the study's research methodology. It considers the theoretical foundation of the methodology used. This chapter also captures the study's data and describes the data sources.

The fifth chapter focuses on empirical findings, analysis, and results of the generated study based on the research questions and objectives. Chapter six summarizes and concludes the study while also offering policy recommendations and limitations.

CHAPTER TWO

REVIEW OF LITERATURE

2.0 Introduction

For decades, the majority of theoretical and empirical research has focused on unemployment and general economic growth. However, research on the relationship between economic growth and unemployment appears to be scarce, particularly in Africa. Furthermore, most research on economic growth and other macroeconomic indicators use aggregated economic growth, which obscures the disparities in the effects of different sectors of the economy. This study will contribute to current research on economic growth and unemployment by revealing the full effects of various types of economic growth on unemployment in Sub-Saharan Africa using disaggregated forms of sectorial growth.

2.1 Empirical Review

According to Andrei et al. (2009), in order to achieve long-term improvement in living standards, policymakers must examine the link between real GDP growth and unemployment. Mohr and Fourie (2008) looked into some of the primary factors that contribute to long-term economic growth. They claimed that these factors can be split into two main groups: supply factors (which result in an increase in production capacity) and demand factors (which refer to a sufficient and increasing demand for the produced goods and services), both of which are necessary for long-term economic growth.

Fuad (2011) investigates the relationship between unemployment and economic growth in Jordan using Okun's law. Using annual data from 1970 to 2008, time series techniques are used to assess the link between unemployment and economic growth and to determine Okun's coefficient. The study employed Augmented Dickey-Fuller regression for unit root, cointegration test, and a simple

regression between unemployment rate and economic growth (ADF). Okun's law does not applicable to Jordan, according to the empirical evidence. As a result, Jordan's unemployment problem cannot be attributed to a lack of economic growth.

Mahmoud (2012) used Okun's law to examine the relationship between economic growth and unemployment in Arab nations. He found that while the two variables do have a positive relationship, high rates of economic growth and a decline in the unemployment rate do not necessarily indicate a strong correlation between GDP-growth and unemployment. Using the Hodrick-Prescott filter1 and the least square approach, Muhammad (2013) found that a one percent increase in unemployment was followed by a 0.3 percent decline in real GDP growth, demonstrating a substantially weaker link between the two variables, particularly in emerging nations.

Ozel (2013) holds similar views to Mahmoud (2012), but this study was based on data collected from seven industrialized countries (G7) and used to examine the relationship between unemployment and GDP growth before and after the recession. Prior to the crises, productivity and GDP growth had a significant impact on unemployment reduction, according to the research. However, after the crises, the effects were insignificant because GDP expansion eliminated unemployment. Further research by Rosoiu (2014) investigating the link between GDP growth and unemployment in the United States from 1977 to 2011 indicated a substantial connection between the two variables. The research also indicated that the relationship between the two factors was significantly impacted by the financial crisis. However, Cashell (2009) emphasizes that there is a direct correlation between changes in the unemployment rate and the rate of economic growth. In order to evaluate the relationship between macroeconomic factors and unemployment, Dogan (2012) used the Vector Autoregressive (VAR) approach. The study's findings mainly addressed

the effects of GDP growth and inflation on unemployment rates. The data showed that the variables' relationships adhered to both the Phillips curve theory and Okun's law. According to the VAR analysis's findings, unemployment and inflation have a positive link, while GDP growth and unemployment have a negative relationship. The strong positive coefficients of unemployment, labour, and capital revealed a long-run positive link with economic growth, according to Hussain (2012), who utilized a Vector Error Correction Model (VECM) to analyze the link between economic growth and unemployment.

Contrary to the positive association between economic growth and employment, there is a correlation between economic growth and unemployment. In other words, it is expected that higher GDP or economic growth results in lower unemployment rates. Increased GDP growth results in higher employment levels as opposed to unemployment, indicating a positive correlation between GDP and employment. However, in reality, assuming a direct correlation between economic growth and unemployment is not always accurate because it is not always true that employment will increase solely if economic growth rates exceed productivity increases (potential output). Or to put it another way, GDP growth must exceed the growth rates of the labour force and productivity for the unemployment rate to decline over the long term (Levine, 2013).

Due to the dynamic interrelationship between the variables used to gauge how quickly the economy was adapting to the unemployment crisis, Madito and Khumalo (2014) used the Error Correction Mechanism to study the relationship between unemployment and economic growth in South Africa from 1971Q1 to 2013Q4. Approximately 62 percent of economic growth is adjusted every quarter. Overall, the results showed that economic development and unemployment are negatively correlated in South Africa.

Kemi and Dayo explore unemployment and economic growth in Nigeria (2014). The goal of this research is to determine the legality of Okun's law in Nigeria. The Error Correction Model (ECM) and Johansen cointegration test were used to determine both the short and long run relationships among the variables included in the study. According to empirical research, the unemployment rate and economic growth in Nigeria have a short- and long-term link.

Yilmaz (2014) investigated the effects of general economic growth on unemployment in Turkey from the first quarter of 2010 to the third quarter of 2013. The model's variables include the unemployment rate, real GDP growth rate, real export growth rate, and real FDI inflows growth rate. In the inquiry, the bound testing technique based on the autoregressive distributed lag model was used. The empirical data in Turkey reveal a negative relationship between unemployment and economic growth.

Ogbanga (2018) examined at the expansion of Nigeria's agricultural industry and its effects on employment creation. The study's variables included the employment rate, gross domestic product, foreign private investment, federal government spending, and industrial sector production. Using error correction and Granger Causality techniques, the impact of the agricultural sector on the creation of jobs was evaluated together with other explanatory variables. The main conclusion of the study is that the expansion of the agricultural and industrial sectors has a positive impact on employment creation.

2.2 Theoretical Review

Numerous research have been conducted on the correlation between economic growth and other important macroeconomic variables in various nations. These studies produce a range of results and conclusions because of variations in the methodology and data employed. Limited but varied study has been done for years on developed, emerging, and developing nations to determine the

impacts that economic growth has on unemployment and vice versa. The Okun's Law is primarily discussed in theoretical reviews. Therefore, the purpose of this study is to investigate theories and ideas about both economic growth and unemployment as a tool for fiscal policy. Prior to that, the study investigates unemployment and economic growth as a vehicle for fiscal policy in distinct and succinct reviews.

2.3 Unemployment theories

The concepts of economic growth and unemployment are the most important factors that influence how all economies select and put into practise economic policies.

Many theories attempt to explain the connection between unemployment and economic growth. Only one of the theories is, however, covered in this article. The main goal of Okun's Law was to clarify how unemployment and economic growth interacted in a particular economy. The idea is that, in any economy, unemployment has a bad impact on economic growth. The study found a correlation between a 3% drop in the unemployment rate and a 3% increase in economic growth. When Kwami (2015) evaluated the validity of Okun's theory of unemployment, he found that it did indeed suggest the existence of a negative relationship between unemployment and economic growth. The Keynesian unemployment theory, also referred to as the cyclical or deficient demand theory of unemployment, contends that insufficient demand in an economy is a major factor in unemployment, which occurs when people who are willing to work at the going rate of pay are unable to find employment at a particular time [Index Mundi 2017; FAO, 2019]. This theory contends that as demand for goods and services declines, so will output, resulting in a reduction in the number of workers needed for production. Even if full employment is reached, some employees will continue to be unemployed because there is an economic mismatch between the number of unemployed workers and the number of open positions. This theory contends that

greater government spending is necessary for an economy to increase employment, increase aggregate demand, and reduce unemployment.

Another popular explanation that explains unemployment is the Marxist theory, which was put forth in 1863 by the Marxist school headed by Karl Marx. The argument holds that because of the capitalism system's insatiable nature, unemployment is a given in any economy. Capitalists control the labour market by creating unemployment, which lowers the demand for labour and lowers wages. According to the idea, overthrowing capitalism and implementing a socialist economic system is the best way to minimize unemployment.

2.4 Economic Growth theories

One of the theories that explain how an economy expands is the classical theory of economic growth. For instance, Adam Smith claimed in his classic work "An Inquiry into the Nature and Causes of the Wealth of Nations" that capital accumulation and labour productivity determine a country's wealth. This theory is in sharp contrast to Keynesian economic theory because it downplays the significance of the role that governments play in economies. According to Smith (1937), in order for economies to experience faster rates of growth, they must amass more capital, which is necessary for specialization and the division of labour. This model also emphasizes how crucial labour specialisation and division are to a nation's economic development.

Another well-known theory is Solow's [1956] neoclassical growth model. This model demonstrates how an economy's capacity for capital accumulation affects its ability to grow. According to the model, labour and technology growth are determined exogenously. The model asserts that labour grows at a constant rate to support this assertion. As a result, the model contends that key variables influencing an economy's growth rate include population growth and the savings rate (growth rate per capita income). Countries with higher savings rates and lower capital costs

are predicted to experience faster growth in per capita income because investments and savings add up to capital in an economy.

The other growth model considered in this study is the endogenous growth model presented by Romer in 1986. This model differs from the neoclassical model in that it views technological advancement as an endogenous outcome, whereas the neoclassical model views it as an exogenous outcome. The endogenous growth model explains an economy's technological progress well by the country's knowledge acquisition. As a result, the basic idea of this model is that economic growth is powered by technological improvement, which is fueled by knowledge accumulation. Indeed, this model predicts that countries that spend a high proportion of their GDP on education will be more productive than countries that spend a low proportion of their GDP on education. As a result, this model emphasizes the critical significance of human capital investment in economic growth. Other growth theories include Keynesian growth theory, proposed by John Meynard Keynes in his important book "The General Theory of Employment, Interest, and Money" in 1936. The idea gained prominence after the classical school failed to explain the Great Depression in 1929. This model advocates for government intervention in the economy to enhance government spending, which leads to improved economic growth.

CHAPTER THREE

OVERVIEW OF ECONOMIC GROWTH AND UNEMPLOYMENT IN SUB-SAHARAN AFRICA

3.0 Introduction

This chapter examines Sub-Saharan Africa's economic growth and unemployment.

3.01 Definition of Concepts

Economic growth

Gross domestic product (GDP) was employed as a proxy for economic growth in this analysis. According to Krugman (2000), GDP is the monetary value of all final goods and services produced inside a country's borders within a specified time period. Both real and nominal GDP can be used as indicators of economic growth. The rate of economic growth can be determined using both real and nominal measures of GDP. Real GDP refers to the quantity of economic output produced during a specific time period after adjusting for changes in the general price level. The nominal GDP is the total market value of a country's economic output produced inside its boundaries in a given year (Swan, 1956).

Unemployment

Unemployment is a phenomenon of job searching that occurs from joblessness. A person is deemed unemployed if they have attained the minimum age for employment, such as 15 years old, and were "without work," "available for work," and "actively seeking work" during a reference week (ILO, 1982). According to this definition, a jobless person who is available for work but for different reasons chooses not to look for a job cannot be categorized as being unemployed; instead, they are simply considered to be discouraged workers. Additionally, someone who is working full-time and chooses to look for (extra) work with another company is only moonlighting Baah-

Boateng et al. (2013). A person is considered to be unemployed when they are actively seeking employment but are unsuccessful in doing so (Bean & Pissarides, 1993). This suggests that the unemployment rate is the percentage of working-age people over the age of 16 who lost their jobs or were unable to find work in the previous month and are now actively looking for work (Moosa, 2008).

3.02 Unemployment in Sub-Saharan Africa

In 2019, there were over 34 million unemployed people in Africa. 12.2 million of them were young people between the ages of 15 and 24. (Figure 3.1). The number of young people without jobs increased by over 1.5 million, or 6.4 million, in 2010. Indicating that unemployment is a major labour market concern in Africa, the regional unemployment rate of 6.8% was much higher than the global average of 5.0%. Despite the continent of Africa having a low unemployment rate, most jobs there are informal.

With approximately 34% of the labour force unemployed, South Africa has the highest unemployment rate in all of Africa in 2021. Djibouti and Eswatini were next, with unemployment rates of almost 28% and 26%, respectively. The lowest unemployment rates in Africa were found in Niger and Benin. The average for the continent that year was close to 8%. Due to a multitude of educational, socio-demographic, and economic factors, young people are more likely than older people to experience unemployment in the majority of countries around the world. In Africa, the average young unemployment rate in 2022 was 13%. The situation was especially bad in several countries. Some of the notable forms of unemployment in Sub-Saharan Africa are enumerated below:

Seasonal unemployment

When people experience seasonal unemployment, it's because they work in fields where their services aren't required all year round. According to Njoku and Inugba (2011), weather fluctuations, shifts in consumer preferences, or the enduring nature of such industries are the causes of seasonal variations in the operations of various industries. For instance, farm workers in Vineyards in the Western Cape are categorized as seasonal workers in South Africa's agricultural industry. They often experience high demand during the harvest and low demand throughout the off-seasons (Banda, et al., 2016).

Frictional unemployment

This type of unemployment occurs when employees leave their jobs but have not yet found new ones. The majority of workers leave on their own, either because they have to move or because they have enough money saved up to seek for decent opportunities (Sweezy, 1934). As parents are ready to enter the workforce or as students search for their first job, frictional unemployment can also happen. Additionally, it happens when workers are fired or, in some situations, laid off as a result of business-specific events like factory closures. Frictional unemployment is a frequent aspect of the employment search. Frictional unemployment does indeed help the economy by enabling workers to migrate to more fruitful positions (Chatterjee, 1995). Due to a lack of communication services like smartphones, the internet, and employment centers, this form of unemployment is prevalent in Sub-Saharan Africa, where unemployed unskilled laborers move from one location to another (Mafiri, 2002).

Structural unemployment

This type of unemployment happens when an industry or a nation's economic activities go through structural change, and it is rather widespread in Sub-Saharan Africa (Njoku & Inugba, 2011). Unexpected technical developments, inflation, recession, and changes in taste and preference are additional factors that contribute to rising unemployment rates. The South African economy had a period of rapid technical development, which increased the capital-intensiveness of many firms and led to structural unemployment because human labor was no longer necessary in many fields, according to Smit et al. (2006). According to Yager (2010), structural unemployment happens when economic developments lead to a mismatch between people's skills and what businesses need in terms of talent. Workers' abilities may get stale if they are unemployed for an extended period of time. If they are reluctant or unable to accept entry-level or unskilled jobs, they may remain unemployed for a long time after the economy has recovered (Pissarides, 1989). Natural unemployment rates rise in this situation as a result of structural unemployment.

Cyclical unemployment

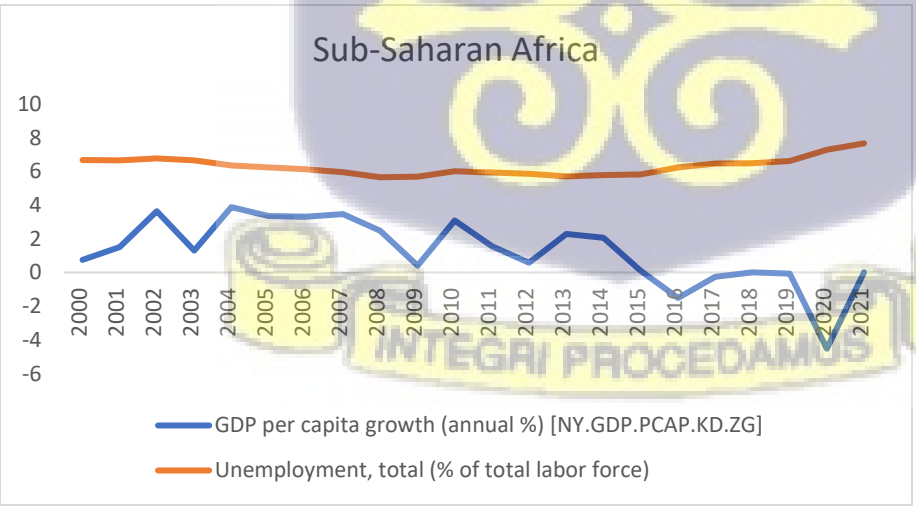
During the business cycle, cyclical tendencies in growth and production are tied to cyclical variations in unemployment. Cyclical unemployment is a result of the business cycle's contraction period. When this occurs, demand for goods and services drops significantly, causing companies to lay off employees in an effort to reduce costs (Barro & Sal-Martin, 1995). Cyclical unemployment typically results in more unemployment due to the fact that fired employees have less money to spend on necessities which further diminishes demand (Sweezy, 1934). Because overall economic productivity is greatest during business cycle peaks, cyclical unemployment will be low. According to Mafiri (2002), cyclical unemployment in South Africa has a trait that makes it difficult to treat adequately. On top of that, there is a risk of widespread structural

unemployment. As a result, the unemployment problem has gotten significantly worse, more complex, and difficult to resolve.

3.1 Economic Growth-Unemployment in Sub-Saharan Africa.

All African states that are largely or completely south of the Saharan Desert are classified as Sub-Saharan Africa (SSA) (United Nations, 2011). The SSA population is currently projected to be 936.1 million people, with forty-eight nations making up the region (World Bank, 2018). According to the International Labour Organization (ILO) forecast for 2017, there will be over 201 million unemployed people globally in 2017, with an extra 2.7 million projected in 2018. According to the report, third-world countries, particularly Africa, will be the hardest hit, with high unemployment and poverty rates. The issues of high unemployment rates and slow output growth are not unique to emerging countries; but industrialized countries have employed strong economic and political policies to reduce unemployment over time. There is empirical support for Okun's (1962) assertion that a high unemployment rate has a negative effect on economic growth. The unemployment rate of a nation ultimately determines its economic stability.

Figure 3.1: Economic Growth and Unemployment in Sub-Saharan Africa.



Source: World Development Indicator (2022)

3.11 Economic Growth and Unemployment Drivers.

Numerous research on how employment and unemployment affect GDP growth rate show that employment has a positive effect on GDP and that unemployment has a negative effect. The Sub-Saharan African region has one of the lowest growth rates in the world, which can be attributed to the effects of unemployment and potential resource mismanagement.

Employment and economic growth do not appear to go hand-in-hand in Africa over time, despite the supposed benefit of pro-employment growth in the fight against poverty (Martins, 2013). The World Bank states that between 2016 and 2017, Sub-Saharan Africa's GDP growth rate increased. According to the Bank's most recent report, economic growth reached 2.6% in 2017 and was projected to reach 3.2% in 2018 and 3.5% in 2019. (2019). Sub-Saharan Africa has the problem of low-quality employment as opposed to unemployment and occasionally fails to experience improvement.

According to estimates from WESO, the unavailability of opportunities for working-class youth and adults in Sub-Saharan Africa suggested that at least 247 million people were in vulnerable employment in 2016, which is comparable to 68 percent of all people who had jobs. While a little decline in the proportion of risky employment is expected in the next two years due to an increase in the working-class population, 14.6 million additional persons are expected to enter the population of vulnerable employment. According to the WESO research, the Sub-Saharan area has experienced its worst economic development in 20 years. The supply and demand of workers generally have an impact on the labour market. It is a factor in the labour force's availability to meet market needs for the creation of goods and services. The employment rate, unemployment rate, and the number of working-class job openings make up the fundamental characteristics of a

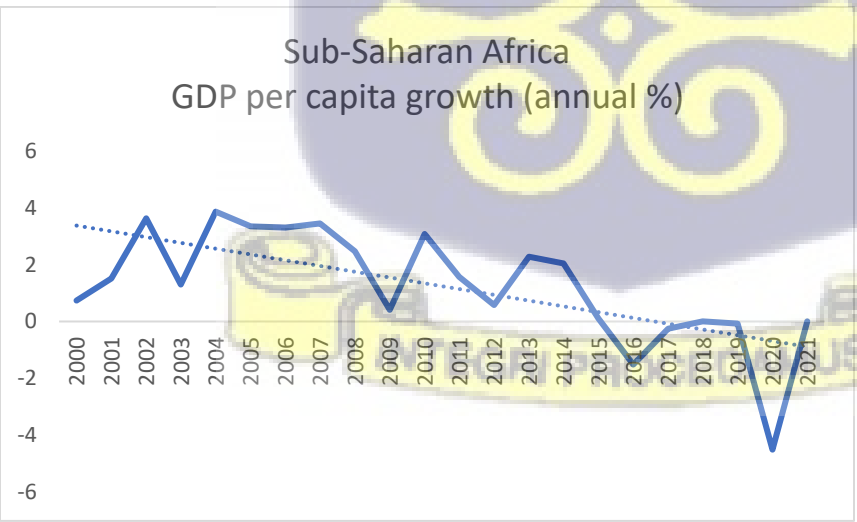
labour market. The fundamental concept therefore revolves around salary, description of employment class size, and employee-to-employer match, which is determined by the human capital's talents, working experience, and educational level.

The labour market's efficiency is thus a result of the interaction between the workforce's trend and the needs of employers. Therefore, the question that arises is whether the job-seeking population meets the requirements demanded by businesses in the labor market. This is because technology is replacing human labor. As a result, the question is whether the hungry working class possesses the required skills and/or knowledge to replace the newly introduced technology in the labor market. And how fast and efficiently are humans able to compete with technology and machinery?

Considering all of this, it should come as no surprise that occasionally people lose their jobs as a result of companies firing employees. Human power is being replaced by technology, so it is up to the population looking for work to better equip themselves with technology in order to keep up with developments in the labour market.

3.2 Trend and features of unemployment in Sub-Saharan Africa.

Figure 3.2: Unemployment Trend in Sub-Saharan Africa.



Source: World Development Indicator (2022)

According to the graph, Sub-Saharan Africa's unemployment rate rose from a record high of 23.8% in 2004 to 22.6% in 2006, before continuing to decline until 2008. When the economy entered a recession in 2008, the unemployment rate was lower than it had been in prior years. As can be seen from the graph, unemployment began to increase slightly during the recession in 2009, and it has continued to rise since then. The rate reached a high of 26.7% in 2016 from a low of 25.3% in 2015. After the 2008 global recession, which resulted in the loss of over one million jobs in South Africa and disproportionately affected young people, the need for employment growth was highlighted negatively.

Unemployment has been a huge issue around the world, particularly among the youth. Statistics from the World Bank, World Employment and Social Outlook (WESO), International Labor Organization (ILO), United Nations (UN), and other organizations indicate that unemployment worldwide is increasing and does not appear to be going down, and Sub-Saharan Africa is no exception. There are more people joining the workforce than leaving it, and little to no effort is being made to increase employment to keep up with the expanding labour force. The worldwide unemployment rate was 197.1 million in 2015, and the World Employment and Social Outlook predicted that it would increase by 2.3 million to 199.4 million in 2016. Additionally, it anticipated that in 2017, the global jobless rate would increase by 1.1 million individuals (WESO 2017).

Sub-Saharan Africa is characterized by its large young population (15-24 years of age), which accounts for 20% of the overall population, 40% of the labor force (employed), and 60% of the unemployed thus this emphasizes the severity of the problem. As a result, the working force is made up of persons ranging in age from 15 to 65. Only youth aged 15 to 24 years account for 40% of the total workforce, implying that those aged 25 to 65 years account for a larger proportion of

the overall population. This means that the unemployed account for a bigger percentage of the population than those who are employed.

According to the International Labor Organization, about 75 million young people aged 15 to 24 were unemployed worldwide in 2011. This represented an increase of almost 4 million people since the start of the global financial and economic crisis in 2007, with nearly 20% of this rise occurring in Africa (ILO, 2012). In 2011, the youth unemployment rate in Sub-Saharan Africa was slightly over the global average of 12.8%, but North Africa had the highest rate with 27.1% globally (Anyanwu, 2014).

Employment opportunities for young people are currently a major concern for international policymakers. This is due to the fact that increasing employment opportunities for young people has the potential to stimulate economic growth, foster political and social stability, and have a positive impact on overall progress toward the Millennium Development Goals and overall poverty reduction. In addition to this, it helps to achieve greater social equality among the children of any given region, as well as more effective resource allocation, higher potential for productivity, and a lower dependency ratio (Ncube and Anyawu, 2012).

3.3 Nature of economic growth in Sub-Saharan Africa

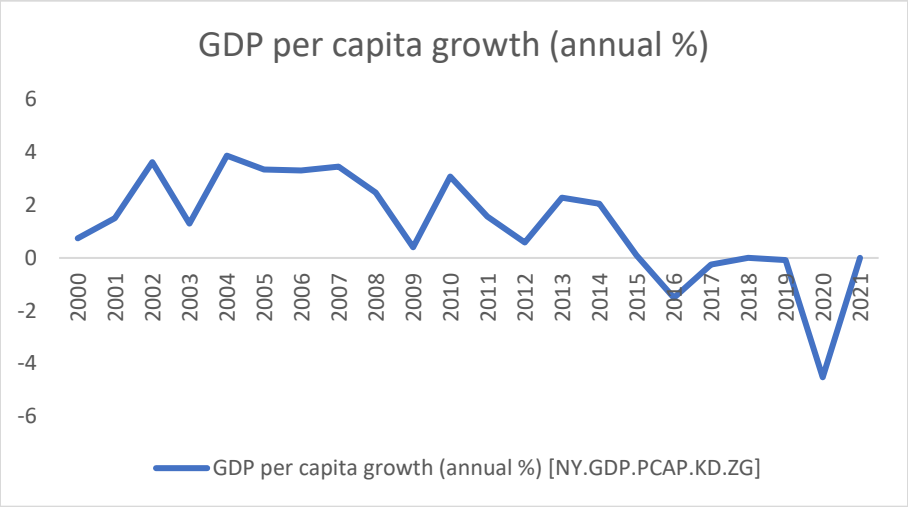


Figure 3.3: Economic Growth Trend in Sub-Saharan Africa

Source: World Development Indicator (2022)

Figure 3.3 depicts the trend of the real GDP from 2000 to 2021 in Sub-Saharan Africa and it's evident from the graph that Sub-Saharan Africa's economy has been expanding, albeit very slowly. From 2003 to 2007, it exhibits an upward trend, which corresponds to an increase in GDP, until the economic downturn in 2009, which exhibits a decline. Though it is developing extremely slowly, the economy appears to be doing well following the recession after slowly recovering after 2010

In recent years, African countries have had rather robust economic growth. SSA countries' growth lagged behind East Asia's 7.2 percent and South Asia's 4.3 percent yearly averages. Angola, Chad, Equatorial Guinea, Ethiopia, Mozambique, and Sierra Leone are among the most populous. In recent years, there has been a movement in the structure and composition of GDP in some SSA nations, particularly Mauritius, away from agriculture and towards services and industry. In 2007, services made for 44.3 percent of SSA's GDP, followed by industry (41.7 percent), and agriculture (41.7 percent) (14.0 percent). Agriculture, manufacturing, and services all had lower relative

proportions in 2007 than in 2000. The overall picture of African economic growth reflects erratic and unsustainable growth patterns.

3.4 The linkage between economic growth and unemployment

When we look at the functional link between growth and unemployment, we can detect two-way causality. Employment has an impact on growth. This means that growth is influenced by the unemployment rate. If the unemployment rate rises, all other factors being equal, the growth rate will fall. The unemployment rate will increase if businesses fire a lot of workers. All other things being equal, a higher unemployment rate will lead to a lower overall output, which will stifle growth. On the other side, expansion leads to employment. As a result, unemployment is a result of economic expansion. All other things being equal, if the rate of growth improves, more earnings and increased demand will follow, and the unemployment rate will decline.

According to Obadan (1997) and Sagbamah (1997), employment and growth move in perfect harmony. The employment rate increases with a quicker rate of growth when all other parameters are held constant. Because of the aforementioned, growth and unemployment go in different ways and hence unemployment rate will fall if the rate of growth rises. Among other things, output affects employment. Overall, more employment will lead to higher output and consequent economic growth. Instead, a decline in employment (unemployment) will have a negative impact on output and, consequently, economic growth (all things being equal).

The preceding indicates that there is a negative association between growth and unemployment. Growth-promoting policies should be designed and executed in order to reduce unemployment. However, it is critical to remember that for growth to reduce unemployment, it must be accompanied with higher labour force participation. According to the classical school of thought, this raises demand for goods and services, which raises demand for labour services, leading in an

increase in employment and, as a result, a decrease in unemployment. However, it is vital to note that the growth that leads to an increase in employment (or a decrease in unemployment) is labor-intensive and accompanied by higher labor-force participation.

The relationship between economic growth and the unemployment rate may not be positive in the short run. It is common for the unemployment rate to keep decreasing even after broad indications of economic activity have improved (Levine, 2013). Because some companies may have employees who aren't being used to their full potential, unemployment may not decline significantly when the economy emerges from the recession. Costs are associated with firing employees during periods of low product demand and hiring them back during periods of high demand. By increasing the productivity of their current personnel, employers may be able to raise output to meet increased demand without adding new staff at the start of the recovery. Long term, this speeds up the rise of labor productivity momentarily over the average rate.

Once labor is fully employed, businesses can only increase output at the rate of productivity growth going forward. The amount of production produced will depend on the rates of growth in the labor supply and labor productivity as an economic expansion continues. The unemployment rate will decrease if employment growth outpaces labor force growth (McCarthy & Potter, 2012). Real GDP growth rates that fluctuate and unemployment have a protracted negative association. The economist Arthur Okun is credited with identifying this long-term connection between these two variables in the early 1960s. In the field of economics, Okun's law is generally acknowledged (Alan, 1997). It argues that real GDP growth approximately equal to the rate of potential output growth is typically necessary to achieve a stable unemployment rate (Knotek, 2011).

The rate of growth in potential output is crucial to comprehending the link between GDP growth rate fluctuations and high unemployment over the long run. If all current labor and capital

resources are put to use, an economy's potential output is an abstract measure of its future productivity (Gordon, 2008). Potential output growth at full employment is set by the rate of increase in both potential productivity and the available labor force (Mitra, 2002). Real GDP falls short of potential GDP when unemployment is high and the term "production gap" describes this condition. So long as every new member of the labor force is able to find a job, production growth will equal the rise in the number of people looking for work, even if productivity growth remains stagnant. There won't be enough openings to go around if GDP growth lags behind the increase in the labor force (Basu & Fernald, 2009). The number of people employed will consequently decrease while the unemployment rate will increase. When firms increase hiring to meet rising demand for goods and services, the unemployed may end up filling some of those positions if production growth outpaces the growth in the labor force. Consequently, the unemployment rate will decrease (Weidner & Williams, 2010).

More people will enter the labor force than are necessary to produce a certain amount of goods and services if GDP growth keeps pace with labor force expansion in the presence of productivity growth. The percentage of people who are employed will decline (Levine, 2013). Alternatively, the unemployment rate will increase. As long as GDP growth outpaces the combined growth rates of the labor force and productivity, unemployment will eventually decline. The GDP rate may be helpful to policymakers who are interested in adopting stimulus plans to lower unemployment. It is obvious that a tendency of economic growth is necessary to lower the unemployment rate (Bernanke, 2012).

CHAPTER FOUR

METHODOLOGY AND DATA

4.0 Introduction

This chapter discusses the methodologies and procedures utilized to achieve the study's objectives, as described in section 1.3. It consists of the theoretical framework, model specification, data source, and estimations. 25 Sub-Saharan African countries were studied using the panel data estimation method between 2000 and 2021. Panel data models assess group (individual-specific) effects, time effects, or both to address heterogeneity or individual effects that may or may not be observed (Park, 2011). These impacts may be random or fixed.

We used pooled OLS regression, fixed effects, and random effects modeling as our three panel data estimation methods. To be more precise, an initial visual inspection was carried out using a graphical method. A test for variable stationarity will be carried out to ensure that the variables are stationary in order to prevent any incorrect analysis in the first place. The Fisher type Panel unit root test, developed by Choi (2001), will be used in this inquiry. The Johansen cointegration test and the Vector Error Correction Model (VECM) were then used. The VECM investigates both short-term dynamics and the long-term relationship, in contrast to the cointegration test which only looks at the long-term equilibrium relationship between variables. On the other side, the granger causality test, variance decomposition, and impulse response were used. We then examined the impact of economic growth on unemployment using a pooled OLS model.

4.1 Model Specification

This study models economic growth as a function of the explanatory variables made up of unemployment and the relevant control variables, which are foreign direct investment (FDI), trade openness, and inflation. This study aims to analyze the relationship between economic

growth and unemployment. This study employs regression analysis to examine the relationship between the dependent variable and the independent factors discussed later in the paper. The panel data analysis baseline model is described below; *GDP= f (UNEMP, FDI, TRO, INF)*

The function is transformed into the generalized equation below in order to estimate the β parameters;

$Y_{it} = \alpha + \beta_1 \, Unemp_{it} + \beta_{j+1} X_{it} + \delta_t + \phi_j + \mu_{it}$ …… (1)

Where: I= 1……10 t= 1……., T

Y_{it} = Annual GDP growth for country I at period t.

$Unemp_{it}$ = Unemployment rate for country I at period t.

X_{it} = control variables including FDI, trade openness, population and agric.

δ_t = Time variant factors affecting GDP (Time -Fixed Effects)

ϕ_j = Country Fixed Effect.

β_1 = the coefficient on unemployment.

β_{j+1} = the coefficient on control variables.

μ_t = Error term

i = index for countries.

t = index for time period which is in years.

Moreover, Makun and Nnanna (2015) and Yilmaz (2014) specified an unemployment-economic growth model relationship as thus,

UNEM = f (GDP)…….. **(Model 1)**

Where: UNEM = Unemployment rate and GDP = Gross domestic product

The current research alters equation 1 and uses a disaggregated method, which means that some of the sectors that contribute to the Gross Domestic Product (GDP) in Sub-Saharan Africa are incorporated into the model as explanatory variables alongside a few control variables. This enables us to determine how the unemployment rate affects the various economic sectors. Agriculture, manufacturing, and services make up these sectors, and the essential control variables include foreign direct investment (FDI), trade openness, and inflation. As a result, the relationship between the unemployment rate and economic growth forms the basis of this study.

UNEMP = f (GRAGR, GRMAN, GRSER, FDI, TRO, INF) …….. **(Model 2)**

$$UNEMP = \beta 0 + \beta\ 1GRAGR + \beta 2GRMAN + \beta 3\ GRSER + \beta 4FDI + \beta 5TRO + \beta 6INF + \varepsilon_t \ldots (1)$$

UNEMR = f (GDPGR, FDI, TRO, INF)

$$UNEMP = \alpha_0 + \alpha_1 GDPGR + \alpha_2 FDI + \alpha_3 TRO + \alpha_4 INF + \varepsilon_t \ldots\ldots (2)$$

4.4 Source of Data and Variables Description

In order to quantify the impact of unemployment on the growth (GDP annual growth) of a few selected emerging Sub-Saharan African nations, the study used macro level yearly secondary panel data. The World Bank's African Development Indicators (2022) edition provided the data for this study, which was conducted between 2000 and 2021 on an annual basis. All required analysis for the study was performed using the statistical software package EViews 12. These 25 nations were chosen based on their economies' high unemployment rates and the availability of data; as a result, the analysis of the study shed greater light on the significant fluctuations in these core macroeconomic variables. The aforementioned countries include Burkina Faso, Burundi, Cote

d'Ivoire, Cameroon, Niger, Nigeria, Rwanda, Senegal, Gambia, Mauritania, Tanzania, Ghana, Namibia, Guinea-Bissau, Lesotho, Madagascar, Malawi, Sierra Leone, Mauritius, Uganda, Zimbabwe, South Africa, Mozambique, Guinea, and Zambia. To identify evidence of causation between variables in higher middle-income countries, low-income countries, and lower middle-income countries, respectively, the study will divide SSA nations into three groups using the World Atlas technique in order to conduct the analysis. As indicated in Chapter 3, one of the reasons this study focuses on Sub-Saharan Africa is because it has one of the highest unemployment rates in the entire globe.

Real GDP Growth: This serves as the study's primary explanatory variable. To account for the impact of economic growth on unemployment, we take into account the real GDP growth lag. Most empirical investigations have shown the Okun's law relationship between unemployment and GDP growth, which broadly represents the notion that as economic growth rises, unemployment falls. According to Anyanwu (2014), a nation's economic growth should boost employment through incentivizing people to join the labor force. Because the majority of the nations in the region have had consistent economic growth, we anticipate a negative correlation between GDP growth and unemployment in SSA, as predicted by Anyanwu (2014). This control variable's data comes from the World Development Indicators database.

Unemployment: According to the WDI, unemployment is defined as the proportion of the labour force that is unemployed yet willing and eager to work. The data is modelled in accordance with International Labor Organization (ILO) standards and is expressed as a proportion of the entire labour force.

Foreign Direct Investment (net inflows): According to WDI, foreign direct investment (FDI) refers to net investment inflows that are utilized to acquire long-term management ownership in a

business that operates in a market other than the investor's own. According to the balance of payments, it is made up of short-term capital, other long-term capital, reinvested earnings, and equity capital. "Foreign direct investment" refers to an investment that involves a long-term partnership and shows a persistent interest and control by a resident entity in one country (foreign direct investor or parent firm) over a company with its headquarters in another economy. FDI is crucial to the expansion of the labor market in the majority of African nations where access to capital is a key barrier. Additionally, FDI-related employment generally tends to increase the country's overall labor productivity (Coniglio et al., 2015).

Trade Openness: Researchers typically quantify the degree to which nations are open to international trade by looking at how much they import and how much they export. This is referred to as "trade openness." On the other hand, the economic performance of these nations is typically evaluated based on their gross domestic product (GDP) or their productivity in a variety of forms.

Agriculture: The agriculture sector was represented by agriculture value-added and this factor is expressed as a percentage share of GDP. According to the WDI measure, agriculture value-added includes animal production, crop cultivation, hunting, and fishing in addition to these other activities. Value added is the term used to describe the net output of a sector after adding up all outputs and subtracting intermediate inputs (WDI, 2019). In Africa, agriculture continues to provide employment for a sizable section of the working population (ILO, 2018). In the sub-Saharan region, particularly in rural regions, the agricultural sector employs a bigger number of employees.

Manufacturing: It is the production of goods for sale or consumption through the use of tools, machinery, human labor, chemical and biological formulations. It is measured as a percentage share of GDP and it incorporates both human handiwork and advanced technology in the

transformation of raw materials into final commodities. The development of industries in the modern economy relies heavily on the technological advancement of productive techniques.

Service: The service sector includes a variety of tertiary economic activities that are further split into the following categories: transportation, storage, and communications; wholesale and retail business; restaurant and hotel facilities; finance, insurance, real estate; and business services. It is measured as a percentage share of GDP.

Inflation: This suggests an increase in the nation's average price level that would probably last a year. According to several empirical investigations, the well-known Phillips curve connects unemployment and inflation. Anyanwu (2014) finds evidence in favor of the Phillips curve in his empirical study of young unemployment and intra-African trade. Similar to this, Chaudhry et al. (2012) explain that inflation could lower unemployment in a nation when real wages are declining more rapidly than expected. This is if actual price levels exceed expectations. Salary discussions increase employment, which also reduces unemployment. A contradictory theoretical prediction states that unemployment may increase during periods of high inflation due to increased manufacturing costs when employees adjust their real wage. Due to the increased cost of production and low wages of their employees, employers would likewise respond by cutting employment. As a result, the inflation variable's sign is uncertain. The change in the Consumer Price Index (CPI), which is based on data from the World Development Indicators database, calculates the cost of purchasing a typical consumer's normal basket of goods and services.

4.2 Panel data Estimation Techniques

The relationship between economic growth and unemployment was examined using the panel data econometric technique. First, in this study, methods for fixed and random effects were employed. A fixed effect model analyzes the correlation between the predictor and outcome variables within

an entity (i.e., Country, firm, etc.). The predictor variable may be influenced by the individual, which must be considered, according to the fixed effect model. Calculating the overall contribution of the predictors to the dependent variable is made simple by the fixed effect, which removes the time-invariant characteristics from the equation. To do this, either the within transformation or the first difference transformation is applied.

On the other hand, we use the random effect model if there is any reason to believe that differences across units influence the outcome variable. The random effect model assumes that each individual effect is random and independent to the regressors.

However, a decision must be taken regarding which of the two models, fixed effect or random effect, provides accurate and dependable parameter estimates. The Hausman test will be conducted to decide which model should be utilized. It involves comparing the alternative hypothesis, that the fixed effect model is the most appropriate and effective model, with the null hypothesis, that there is no relationship between regressors and individual effects (the random effect is appropriate). If the results are significant, that is, if the prob>chi2 is greater than 0.05 and we cannot reject the null hypothesis that the random effect model is appropriate, we favor the random effect model over the fixed effect model; otherwise, we opt for the fixed effect model.

Additionally, the Granger causality test, Johansen's (1988) cointegration approach, the Vector Error Correction Model (VECM), and panel data analysis were employed to examine the relationship between economic growth and unemployment in SSA nations. In this investigation, the VECM was employed because Vector Autoregression (VAR) models incorrectly represent cointegrated variables. In general, VAR models do not imply long-term relationships; rather, they eliminate them when they diverge. However, the VECM can differentiate between long-term and short-term correlations and can reveal causation between variables that normal Granger causality

cannot (Oh & Lee, 2004). Before undertaking cointegration analysis, it is vital to determine whether the series is stationary. The Augmented Dickey-Fuller (1979) test was used to determine whether or not the series was stationary. There is the possibility of a cointegration relationship between the series if their differences are stationary but their levels are not, revealing their long-term link. Johansen's cointegration test was utilized to assess the long-term relationship between two variables.

Test for Over-identifying Restrictions

Over-fitting of endogenous variables is caused by the tendency of panel data estimations for the number of instruments to expand exponentially with the number of time periods (Heid and Larch, 2012). However, the instruments of the endogenous variables must be legitimate for the estimator to give accurate and dependable findings. Thus, a correlation must exist between the instruments and endogenous explanatory variables, but not between the residuals and the explanatory variables. Consequently, we evaluate the validity of instruments using the Sargan tests for over-identifying constraints. If the employed instruments are actually valid and therefore exogenous under the null hypothesis that they are valid against the alternative that they are invalid, and are also connected with the error term, then the null hypothesis is not rejected. This is indicated by a p-value > 0.05.

Unit root test

The stationary time series theory is used to estimate the unit root test. The empirical study begins with a look at the statistical properties of the economic variables generated by the model, which are time series in nature. If a series' mean and auto covariance are not dependent on time, it is said to be stationary. The goal of examining these qualities is to determine whether the model's variables are stationary in order to prevent false regression that could produce inaccurate findings (Austeriou & Hall, 2011). The inability of non-stationary time series results to be generalized to subsequent periods provides yet another argument for doing stationarity tests (Banda, et al., 2014).

Phillips Perron unit root test and Augmented Dickey-Fuller unit root test are the two most frequently employed stationary tests (Said and Dickey, 1984). If the variables are found to be stationary in the model, it is frequently anticipated that they will have a constant variance and specific components of autocorrelation over time (Mosikari, 2013).

Visual Inspection

Graphs or a correlogram test can be utilized to demonstrate this technique for stationarity testing. According to Mah (2013), the strategy is effective since it provides an initial indication of the nature of the time series. It indicates whether the tracked variables are increasing, decreasing, or remaining constant. According to Gujarati and Porter, when the logged variable rises or falls, it indicates that the logged variable's mean is changing with time, making the recorded variable non-stationary (2009). The variable is stationary and oscillates around the trend line when it is constant. Due to the fact that it is unaffected by time, more robust techniques, such as the Augmented Dickey-Fuller and Phillips Perron unit root tests, should be utilized to confirm these conclusions.

Augmented Dickey Fuller (ADF) Test

The Dickey Fuller test presupposes that each error term is uncorrelated. Dickey and Fuller (1976) revised the fundamental Dickey-Fuller test to develop and utilize the already Augmented Dickey-Fuller (ADF) unit root test to account for the chance that the error components are linked. On models containing lagged values of the dependent variables, the Augment Dickey Fuller unit root test is utilized to reduce serial correlation in the error term.

In accordance with Mosikari (2013) and Madito & Khumalo, the following regression is generated for each model variable for the ADF test (2014).

$$\Delta Y_t = \alpha_0 + \beta_t + \sigma_1 Y_{t-1} + \sum_{i=1}^{t} y_i \Delta Y_{t-i} + \varepsilon_t$$

Where α_o is a constant, β_t is the coefficient on a time trend and σ_1 is the parameter to be estimated and ε_t is the error term which is assumed to be normally distributed. The ADF test uses the presence or absence of a unit root in the time series as the null hypothesis. To be considered stationary, a variable must have a critical value greater than the test statistics and a probability value (PV) less than the 1%, 5%, and 10% levels of significance. Because of this, the Augmented Dickey-Fuller statistic has a negative value. Since the unit root grows with a larger negative, no significance can be accepted (Dickey, 1988).

Phillips-Perron

A different approach to determining if a unit root exists in a general time series context is the Phillips-Perron test. The linear trend was part of Phillips' and Perron's (1988) definition. To account for the possibility of serial correlation in the error terms, the ADF unit root test modifies the Dickey-Fuller test by including the lagged differenced terms of the independent variables. Additionally, Phillips and Perron (1988) use non-parametric statistical methods (Gujarati & Porter, 2008) to analyze serial correlation in the error terms without including the delayed differenced terms.

The PP test uses the following regression estimation procedure for all model variables:

$$\Delta Y_t = \mu_0 + \mu_1 Y_{t-1} + \varepsilon_t$$

Where μ_0 and μ_1 are parameters estimates and ε_t is error term. Time series are considered stationary when the critical value exceeds the test statistics and the probability value (PV) is less than the 1%, 5%, and 10% levels of significance. To determine if a unit root exists in a time series, one can apply the PP test.

The choice of lag length

Selecting a suitable lag for our variables is crucial if we want to get desirable outcomes. The lag time is determined by completely at random variables. In order to ensure that the error components are normally distributed without autocorrelation or heteroskedasticity, the lag length criteria is essential. Variables that are eliminated have an effect on the lag time. Therefore, it has an instantaneous impact on how the model operates. The best lag time can be found using any of a number of different metrics, including Aikaike's Information Criterion (AIC), Schward's Information Criterion (SC), Hannann-Criterion Quin's (HQ), sequential modified Likelihood Ratio (LR), and Final Prediction Error (FPE) (FPE). According to Mah (2013) and Davidson & MacKinnon (2011), the following formula is used to determine these criteria for information (2004):

$$AIC = -2\,{}^{l}\!/_{T} + 2\,{}^{k}\!/_{T}$$

$$SC = -2\,{}^{l}\!/_{T} + {}^{(k\log T)}\!/_{T}$$

$$HQ = -2\,{}^{l}\!/_{T} + 2\,{}^{k\log(\log(T))}\!/_{T}$$

$$LR = (T-m)\{\log|\Omega_{n-1}| - \log|\Omega_{n}|\} - X^{2}(k^{2})$$

Where l is the log likelihood l is computed as:

$$l = -{}^{T}\!/_{2}(1+\log)2\prod) + \log({}^{\hat{e}\hat{e}}\!/_{T})$$

Mah (2013) claims that the SC is an AIC substitute that penalizes heavily for having additional coefficients. In addition, HQ has a punishment feature. M is the number of parameters in the equation for the alternative in the sequential modified likelihood ratio (LR) test. We start with the

greatest latency, reduce it incrementally by one lag, then compare the altered LR statistics to the crucial value until we get a rejection. Each criterion is marked with an asterisk next to the selected lag, which minimizes the criterion. When looking for a good lag length criterion, Liew (2004) asserts that the AIC and FPE findings outperform the SC and HQ results when the number of observations is sixty or less.

Johansen cointegration test

Unlike the Engle Granger technique, the Johansen cointegration test allows for a large number of cointegrating interactions. This test considers large samples, or asymptotic properties (Phillips & Ouliaris, 1990). The Auto Regressive Distributed Lags should be used since the results would be invalid if the sample size were too small (Giles, 2014). The Johansen cointegration test represents a linear combination of the data with the highest correlation and is based on the eigenvalues of data transformations. It is guaranteed that the eigenvalues are either nonnegative or real.

According to Johansen (1988), the Johansen methodology starts with the Vector Autoregression (VAR) of order p, as shown below:

$$Y_t = \mu + A_1 Y_{t-1} + \ldots + A_p Y_{t-p} + \varepsilon_t$$

Where Y is a $n \times 1$ vector variables that are integrated of the order one $I(1)$ and ε_t is a $n \times 1$ vector innovations. This VAR can be written as:

$$\Delta Y_t = \mu + \prod Y_{t-1} + \sum_{t-1}^{n-1} \Gamma_i \Delta Y_{t-1} + \varepsilon_t$$

Where $\prod = \sum_{t=1}^{p} A_{t-1}$ and $\Gamma = -\sum_{j=t+1}^{p} A_j$

The $n \times r$ matrices α and β exist if the coefficient matrix $\prod$ has a reduced rank $r \times n$. $\prod = \alpha\beta^1$ and $\beta^1 Y_t$ are stationary, r is the number of cointegration relationship, α is the adjustment parameter in the vector error correction model and each column of β is the cointegrating vector.

The maximum eigenvalue test and the trace test are names for the Johansen tests. Let r represent the rank of. Probability ratio tests include the Johansen tests. The initial Johansen test pits the null hypothesis of no cointegration against the alternative of cointegration for both test statistics (Gregory & Hansen, 1996). The alternative hypothesis is different for each test. The maximum and trace eigenvalue tests are as follows:

$$J_{trace} = T\sum_{i=t+1}^{n} In(1-\bar{\lambda}_1)$$

$$J_{max-eigen} = -TIn(1-\bar{\lambda}_{t+1})$$

Where T represents the sample size and λ represents the ith greatest canonical correlation. r cointegrating vectors is the null hypothesis of the trace test, while n cointegrating vectors is the alternative hypothesis. The maximum eigenvalue test evaluates the null hypothesis of r cointegrating vectors veres the alternative hypothesis of r plus one cointegrating vectors (Thomas, 1985).

Vector Error Correction Model

For use with nonstationary series that are known to be integrated, the vector error correction model (VECM) is a constrained VAR with cointegration restrictions imposed in the specification (Amassoma & Nwosa, 2013). The short run dynamics and cointegrating equation of the series are investigated using the conventional vector error correcting model. When the series fails to cointegrate, the short run model is the next estimation technique since the error correction term for

the coefficient is estimated in this fashion. The link between short run dynamics and long run equilibrium relationships among data series is explained by the VECM concept. Use of VECM is crucial because it is utilized to rectify transient short-run series aberrations from the long-run equilibrium relationship (Eze, Atuma, Egbeoma, 2016). Here is how the VECM model is presented:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 \mu_{t-1} + \varepsilon_t$$

Where:

$Y_t = Y_t - Y_{t-1}$, α_1 and α_2 represent the dynamic adjustment coefficients of the variables, while μ_{t-1} is the residual lag, the term, denoted by t, is the error term that is estimated to rectify the long-term equilibrium error and shows the short-run divergence from equilibrium. Because the inquiry included more than one explanatory variable, it was chosen to apply VECM based on conventional least squares (Asoluka & Okezie, 2011). As a result, applying the procedure in the study is required. The model is depicted below:

$$\Delta GDP_t = \beta_0 + \beta_1 \Delta GDP_{t-1} + \beta_2 UN_{t-1} + \beta_3 FDI_{t-1} + \beta_4 TRO_{t-1} + \beta_5 INF_{t-1} + \mu_t$$

Where GDP denotes the gross domestic product growth rate, β_0 is a constant, β_1, β_2, β_3 β_4 β_5 are the vaues of the explanatory variables and μ_t is the error term of the long run equilibrium error. The dynamic behavior of the study's important variables is analyzed via a vector error correction model approach after the long run equilibrium relationship has been confirmed. By using the appropriate differenced variables to build the model's short-term adjustment, it circumvents the issues of spurious regression (Mah, 2013).

VECM granger causality

Within a Vector Error Correction Model (VECM) framework, the Granger causality test determines the direction of the causal relationship between variables. Effectiveness of the VECM-based causality test can be attributed to its ability to model interconnected but non-stationary variables (Austeriou & Hall, 2011). The following regressions can be used to implement the Granger causality test in a VECM framework (Ageli, 2013; Odhiambo, 2009).

$$y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} y_t - i + \sum_{i=1}^{n} \alpha_{2i} DER\_VOL_{t-i} + ECT_{t-1} + \mu_t$$

$$Dervol_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} DER\_VOL_{t-i} + \sum_{i=1}^{n} \beta_{2i} y_{t-i} + ECT_{t-1} + \varepsilon_t$$

Where, in the preceding equations:

- n represents the number of lag variables.
- α_1, α_2, β_1 and β_2 are a list of the parameters that need to be estimated.
- α_0 and β_0 are constant terms that represent the equation intercepts
- μ_t and ε_t are the error terms or the mutually uncorrelated white noise residual
- ECT_t is the error correction term lagged one period

Diagnostic test

Diagnostic tests are performed to validate the vector error correction model's precision and predictability. Below is a list of diagnostic tests that may be performed: The Breusch-Pagan, White, ARCH, Breusch-Godfrey, Jarque-Bera, Ljung-Box Q, and Ramsey RESET tests are only a few examples.

Normality test

There is a special Lagrange multiplier test for normalcy known as the Jarque-Bera test (Jarque & Bera, 1987). Many statistical tests, such as the T test and the F test, rely on the assumption of normality. The Jarque-Bera test is commonly used to establish normalcy before these kinds of tests. Since the normal distribution has a kurtosis of three and a skew of zero, it is perfectly symmetrical about the mean. The distribution's peak height and the amount of data in the tails are both indicated by kurtosis (Jarque & Bera, 1987). We put the assumption that residuals follow a normal distribution to the test.

Autocorrelation tests

The Ljung-Box Q is a diagnostic tool that was developed by Box and Pierce in 1970. Its purpose is to evaluate the robustness of a time series model, or the lack thereof. Following the application of an ARMA model to the data, the test is carried out on the residuals of the time series. The test investigates the residuals' innate relationships with one another (Ljung & Box, 1978). The Breusch-Pagan Test, which was devised by Breusch and Pagan in 1980, is utilized in the process of determining whether or not the model contains serial correlation. The alternative null hypothesis for the Breusch-Pagan test is given by:

$$\sigma_i^2 = \sigma^2 h(z_i^{'}\alpha)$$

Where h is an unknown, continuously differentiable function (that do not depend on *i*) such that h(0) > 0 and h(0) = 1 . A test for: H_0: $\alpha = 0$ versus H_0: $\alpha \neq 0$ can be derived independently of the function *h*. The simple Breusch-Pagan test can be computed by multiplying the number of observations by the R^2 of and of e_t^2 (the squared OLS residuals) on z_i together with a constant. This allows for the calculation of the test. A Langrage multiplier test for heteroskedasticity, the

Breusch-Pagan test is sometimes known as the Breusch-Pagan test. Lagrange multiplier tests' main advantage is that they may be calculated using the R^2 of an auxiliary regression without requiring the model to be estimated under the alternative. The Breusch Godfrey test, which was expanded by Breusch (1978) and Godfrey, is applied in order to assess whether or not a time series contains serial correlation (1978). The test makes use of the residuals that were generated by the regression analysis model, and a test statistic is generated from the data that they provide. The absence of any kind of serial relationship, regardless of the order, is referred to as the null hypothesis.

Heteroskedasticity tests

One of the most important steps in the estimating process for panel data is the test for heteroskedasticity, a cross-sectional data estimation problem. Because cross-section is covered by panel data, this estimation problem is probably present in our estimations. Heteroskedasticity is present when the error term's variance fluctuates between observations and renders it non-constant (that is Var (εit) $\neq \sigma 2$). Wooldridge (2008) argues that the T and F tests produce misleading findings because heteroskedasticity renders parameters meaningless. When the Hausman test is consistent with the fixed effects model, we will employ the modified Wald test for heteroskedasticity. To account for the possibility of heteroskedasticity, a powerful command will also be executed. This method provides standard errors of regression coefficients that are robust against heteroskedasticity. The white test (White, 1980) employs the idea of a heteroskedasticity consistent covariance matrix for the OLS estimator and does not necessitate any supplementary structure for the alternative hypothesis. The conventional estimator is:

$$\hat{V}\{b\} = s^2\left(\sum_{i=1}^{N} x_i x_i^{'}\right)^{-1}$$

If there is no heteroskedasticity, the equation above will produce a consistent estimate of V(b), but it will not if there is. The Chi-squared asymptotic distribution of the test statistic has P degrees of freedom, where P is the number of auxiliary regressions regressors (regressors in the auxiliary regression that do not include the intercept). Engle's Autoregressive Conditional Heteroskedasticity (ARCH) model is the most commonly used heteroskedasticity model in time series (1982). An ARCH model starts from the premise that we have a static regression model:

$y = \alpha + \beta_0 + \beta_1 + \varepsilon_t$

Ramsey RESET

Ramsey RESET is used in addition to the diagnostic test to assess whether the error correction model is appropriately stated. Incorrect equation specification, according to Austeriou & Hall (2011), can result in improper functional forms and misspecification bias, which can lead to high R-squared and deceptive results.

Stability test

The reliability of the model is examined using a series of tests predicated on recursive residuals. The CUSUM test and the CUSUM of squares test are the two most essential tests; they use data ordered by time rather than by the value of the explanatory variable (Steward, 2005). A visualization showing the sum of the recursive residuals serves as the foundation for the CUSUM test. If this total deviates from a critical bound, it is assumed that a structural break occurred at the moment the sum started moving in that direction. The CUSUM of squares test is a proportional representation of the cumulative sum of squared recursive residuals, which is similar to the CUSUM test (Marno, 2004).

Impulse response function

An impulse response function is a mathematical model that describes how the value of a particular variable shifts over a predetermined amount of time after being subjected to a shock. It's possible that Granger causality can't provide the complete story of how the variables in a model interact with one another. It is essential to take into account the impulse response relationship in a system with a higher dimensionality (Rossi, 2010).

Variance Decomposition

After a vector auto regression (VAR) model has been fitted, the understanding of the model can be improved with the help of variance decomposition (Rossi, 2010). The auto regression can be used to determine how much additional information is added to the other variables, and the variance decomposition can be used to indicate how much additional information is added. It is possible to estimate the extent to which exogenous shocks to the variables being forecasted could contribute to the variation in forecast error for each variable. Utilizing variance decomposition analysis, which is also known as an out-of-sample causality test from time to time, allows for the identification of the dynamic aspects of the system (Espinoza, 2011). The variance decomposition analysis is a practical method for separating the variance of forecast inaccuracy of a certain variable into components linked to innovations or shocks in each variable in the system. This can be done by dividing the variance of forecast inaccuracy into different components (Ooi, Wafa, Lajuni, & Ghazali, 2009).

CHAPTER FIVE

PRESENTATION AND DISCUSSION OF RESULTS

5.0 Introduction

In this chapter, we show the findings of the diagnostic tests that were performed as described above in the previous chapters, together with their estimation and discussion. Four sections make up the chapter, the first of which, section 5.1, offers a descriptive analysis of the study's variables. Section 5.3 shows the empirical findings from the pooled OLS, fixed effects, and random effects estimate, and Section 5.4 presents the findings from a few diagnostic tests used to determine the estimation's level of robustness. Section 5.5 presents a discussion of the empirical findings. The chapter is finally ends at section 5.6.

5.1 Descriptive Analysis

The descriptive statistics of the relevant variables are briefly covered in this section. It displays the mean, standard deviation, as well as the maximum and minimum values, for the 25 Sub-Saharan African nations included in the study, which runs from 2000 through 2021. The descriptive analysis is displayed in Table 5.1 below.

Table 5.1 **Summary Statistics**

Variables	GDP	UNEMP	FDI	TRADE	INF	AGRIC	MANU	SERV
Mean	4.0809	7.36594	4.50734	61.9892	9.04984	23.9527	10.2737	46.5977
St. Deviation	4.56481	7.38712	8.78657	27.1452	27.806	13.9731	3.96466	9.03775
Maximum	26.4173	35.457	103.337	165.059	557.202	79.0424	24.5578	77.0201
Minimum	-30.145	0.32	-11.199	20.7225	-9.6162	1.92685	1.53261	12.4902
Skewness	-1.4256	1.96007	6.9349	1.18533	16.6048	0.7907	0.3028	0.11555
Kurtosis	13.4486	6.09451	64.05	4.26021	311.469	4.15808	3.54789	3.64798

Source: Authors Own Computation (2022)

According to the above table, the average GDP growth rate for the 25 Sub-Saharan African nations in the sample was 4.08 percent between 2000 and 2021, with a standard deviation of 4.56 percent. The standard deviation shows that GDP growth rates are quite stable, with the minimum and maximum values being 0.3 and 26.4 percent, respectively. FDI, which has a mean of 4.50 and a standard deviation of 8.79 percent, exhibits similar characteristics.

Over the time, the average unemployment rate as a proportion of the labour force overall was 7.36 percent, with a standard deviation of 7.39. South Africa recorded the greatest figure, 33.47%, while Niger recorded the lowest value, 0.29%, in 2001. Additionally, manufacturing's share of GDP averaged 10.27%, with a 3.96 standard deviation. Zimbabwe achieved the lowest value, 2.047%, in 2007, and Namibia recorded the highest number, 54.797%, in 2001. The standard deviation for service as a percentage of GDP was 4.05, with an average of 6.89%. Sierra Leone reported the highest percentage (31.27%) and Mauritania the lowest percentage (0.1%), both in 2010.

Table 5.1 also shows that trade openness averaged 69.99 percent of GDP-PPP with a dispersion of 11.165 percent for the same time period. Since approximately 90% of the territory's economic activity can be linked to the movement of goods and services, the highest trade openness shows that the region is substantially opening up to trade. This presents a huge potential to gain from openness.

Regarding inflation, the Consumer Price Index (CPI) showed an average yearly change of 9.05 percent from 2000 to 2021, ranging from -9.61 (lowest) to 557.2 (highest). This clearly shows a high degree of price instability. Again, the standard deviation for foreign direct investment as a percentage of GDP was 7.26, and the average was 13.11 percent. Mauritania recorded the highest value, 52.65%, in 2004. A similar average of 25.79% with a standard deviation of 13.43 was found

for agricultural value added as a percentage of GDP. Botswana recorded the lowest percentage, 1.83%, while Guinea Bissau earned the highest percentage, 61.42%, in 2004.

Agricultural growth had an average standard deviation of 13.97 and a mean of 23.95%. Rwanda reported the lowest number, -6.19%, and the highest figure, 7.92%, in 2003 and 2008, respectively. Manufacturing percentage change has a standard deviation of 3.96 and an average of 10.27%. Burundi had the largest change in 2014, at 85.56%. In 2010, Guinea Bissau reported the largest drop, 74.55%. With a standard deviation of 5.14, foreign direct investment (Net inflows) as a percentage of GDP averaged 2.99%. The Gambia achieved the highest value (50.02%) in 2014, while Gabon reported the largest decline (8.59%) in 2006.

The values of skewness and kurtosis are used to evaluate the normalcy of the variable distribution. With the exception of population growth, which displays a negative skewness score, other variables exhibit positive skewness. A number exceeding 3 is regarded by conventional kurtosis as evidence of non-normality. However, Kim (2013) contends that when the sample size is greater than 300, this criterion might not be accurate. He contends that non-normality is demonstrated by an absolute kurtosis value larger than 7. According to this standard, all variables are normal except for the variables that measure unemployment, foreign direct investment, and agricultural value added.

5.2 **Granger Causality Estimation Results**

For a panel of 25 sub-Saharan African nations, we estimate equations 1 and 2 in this study using the random effect, the fixed effect, and the vector error correction estimates spanning the period 2000 to 2021 (22 years). Again, the results of the Granger Causality test revealed unidirectional relationship between UENMP and GDP with causality running from GDP to unemployment in the

economies., Tables 5.2 which provides the findings of the causal relationships for economic growth and unemployment as well as some control variables are provided below.

Table 5.2 Granger Causality Results

Null Hypothesis	Direction of causality	F-Statistic	P-value
GDP does not Granger cause UNEMP	GDP → UNEMP	6.09604	0.0086
FDI does not Granger cause UNEMP	FDI → UNEMP	3.75987	0.0414
TRO does not Granger cause UNEMP	TRO → UNEMP	2.91703	0.0773
INF does not Granger cause UNEMP	INF → UNEMP	2.55788	0.1025
AGRIC does not Granger cause UNEMP	AGRIC → UNEMP	4.6913	0.0229
MANU does not Granger cause UNEMP	MANU → UNEMP	3.0768	0.0709
SERV does not Granger cause UNEMP	SERV → UNEMP	4.8563	0.0191
UNEMP does not Granger cause FDI	UMEMP → FDI	3.0674	0.1925
INF does not Granger cause TRO	INF → TRO	1.7914	0.0256
TRO does not Granger cause INF	TRO → INF	4.8017	0.0045
FDI does not Granger cause AGRIC	FDI → AGRIC	5.1366	0.0273
AGRIC does not Granger cause MANU	AGRIC → MANU	4.6084	0.1127
GDP does not Granger cause SERV	GDP → SERV	3.7435	0.0226

Source: Authors Own Computation (2022)

Note:

(i) Optimum lag lengths (m) are determined by minimizing the Akaike Information criteria (AIC) by E-views

package.

(ii) * Denotes significant at 5% confidence level.

(iii)The significant result only presented in the table.

The Granger causality test results from Table 5.2 showed a unidirectional relationship between unemployment (UNEMP) and gross domestic product (RGDP), with the economic causation running from GDP to UNEMP. The same goes for the unidirectional reversed flow from UNEMP to FDI, INF, AGRIC, and SERV.

5.3 **Diagnostics tests**

In this section, we show the findings from a few diagnostic tests that were performed in order to make the necessary modifications and acquire accurate and consistent results. The diagnostic tests conducted as outlined in the previous chapter include the Sargan test for instrument validity and the Hausman test to distinguish between fixed and random effects models. Heteroskedasticity and serial correlation (autocorrelation) are also tested for.

5.4.1 Hausman Test

The Hausman test is utilized in our regressions in order to identify whether or not individual heterogeneity is related to the regressors. The results of the Hausman test are shown in Appendices. In this case, the fixed effect model has been replaced with the random effect model. When endogeneity is present owing to the lagged dependent variable and the GDP growth rate variable, we choose the VECM estimate over the VAR because it provides more accurate and consistent results. This is why we prefer the VECM estimate over the VAR.

5.4.2 Heteroskedasticity

We use the GroupWise heteroskedasticity test that is available for the fixed effect model since the Hausman test favors the fixed effect over the random effect. Appendix III of the appendix part contains a picture of the test's outcome. At a 5% level of significance, the test disproves the null hypothesis of homoscedasticity, hence validating the existence of heteroskedasticity in mistakes.

5.4.3 Autocorrelation

For the purpose of carrying out this test, the Arellano-Bond test for serial correlation in first differenced errors is utilized. When looking at unemployment, the results reveal an AR (2) p-value

of 0.449, but when looking at unemployment as the dependent variable, the results reveal an AR (2) p-value of 0.238. Due to the fact that the p-values are greater than 0.05, we are unable to reject the null hypothesis that there is no second order autocorrelation. This is due to the fact that the errors do not appear to be associated with one another.

5.4.4 Test for over-identifying restrictions

The Sargan test is used to determine whether the over-identifying limitations are legitimate, as was described before in the preceding chapter. The Sargan p-values for the test findings shown in our final estimation tables makes us unable to reject the null hypothesis that the instruments are valid for the model because these p-values are greater than 0.05. In light of the Autocorrelation test result as well as the Sargan test result, the panel data estimate should yield consistent and reliable estimates.

5.5.0 Presentation of Empirical Regression Results

The Pooled Ordinary Least Squares, Fixed, and Random Effects estimation approaches are used in this study to investigate the relationship between economic growth and unemployment in Sub-Saharan Africa during the period of time spanning from 2000 to 2021. In situations when there is no individual effect, such as in a cross-sectional or time-specific effect, the pooled OLS provides estimations of parameters that are accurate and dependable (Park, 2011). The possibility of heterogeneity in the panels or countries is taken into account by using both Fixed and Random effect estimate methodologies. The Fixed effects model changes the model to get rid of the heterogeneity on the presumption that it is not random. But because the Unpredictable effects presume that heterogeneities are random, it captures them using a random mistake. To choose the most suitable model, the Hausman test is applied. Table 5.3 below shows the outcomes for the Pooled OLS model along with the standard errors in brackets.

Table 5.3 Pooled OLS Regression

Variable	Pooled OLS GDP	Pooled OLS (Robust Results) GDP (Model 1)
UNEMP	-0.1259***	-0.1259***
	(0.0309)	(0.0359)
FDI	0.0773*	0.0773*
	(0.0419)	(0.0498)
TRADE	0.0065	0.0065
	(0.0085)	(0.0108)
INF	-0.0213***	-0.0213***
	(0.0063)	(0.0025)
AGRIC	-0.0137	-0.0137
	(0.0242)	(0.0318)
MANU	-0.1169*	-0.1169
	(0.0626)	(0.0887)
SERV	0.0092	0.0092
	(0.0328)	(0.0449)
Constant	5.9002	5.9002
Observations	429	429
R-squared	0.0952	0.0952
Number of Countries	25	25

Source: Authors own estimation (2022)

Standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Fixed Effect and Random Effect Estimation

Fixed and Random Effect models results are presented in Table 5.4 below with the standard errors in parenthesis.

Table 5.4: Fixed and Random Effect

Variable	Fixed Effect GDP (2)	Random Effect GDP (Model 2)
UNEMP	-0.2114	-0.1563***
	(0.1451)	(0.0448)
FDI	0.0550	0.0732
	(0.0523)	(0.0448)
TRADE	0.0595***	0.0194**
	(0.0176)	(0.0111)
INF	-0.0287***	-0.0246***
	(0.0067)	(0.0063)
AGRIC	-0.0251	-0.0059
	(0.0577)	(0.0304)
MANU	-0.00196	-0.0935
	(0.0983)	(0.0736)
SERV	0.0256	0.0193
	(0.0509)	(0.0397)
Constant	1.883	4.4614
Observations	429	429
R-squared	0.2107	0.0823
Number of Countries	25	25

Source: Authors own estimation (2022)

Standard errors in brakets, *** p<0.01, ** p<0.05, * p<0.1

5.6 Hausman Test

The Hausman test will be utilized as the next step in the process of determining whether or not the fixed effects model is adequate. The fixed effect model, as was already established, does not account for heterogeneity, but the random effect model integrates the individual nation-specific variability into the error term. The conclusions drawn from the fixed effects model become distorted and paradoxical if any one of these country-specific traits is related to any of the explanatory variables. The results of the Hausman test indicate that the fixed effects model and the Random effects model produce identical findings. However, in the event that this theory is disproved, it can be deduced that the fixed effects model does not adequately describe the data since the elements that explain the results may be related to characteristics that are unique to certain nations. The test outcomes are listed in Table 5.5 below.

Table 5.5: Hausman Test Results

Ho	**Differences in coefficients**
Chi-Squared	13.071
p-value	0.07

Source: Authors own estimation (2022)

Since the p-value is greater than 0.05, we fail to reject the null hypothesis. Hence the Random Effects is the appropriate model.

5.6.1 Interpretation

The primary objective of this research is to investigate the connection that has been hypothesized to exist between sub-Saharan Africa's rising GDP and its persistently high unemployment rate. Given that the Hausman specification test (Hausman, 1978) found the Random effect model to be appropriate for the investigation, the interpretation of the data will be based on an estimation using the Random effect model. Instead of reading the coefficients right away, it is more fascinating to interpret the elasticity values that surround the mean values of the variables.

According to the results for random effects, the agriculture production expenditure coefficient displayed a substantial and positive sign. This shows that an increase in agricultural production will reduce unemployment in Sub-Saharan Africa, assuming all other variables remain constant.

The estimated impact of the service industry on unemployment as a share of GDP is also shown to be positive, despite the fact that none of the three models detect any statistically significant link between the two. The Pooled OLS model together with the random effect models, finds that agriculture value-added as a proportion of GDP reduces unemployment, which is consistent with the a priori expectation.

A 1% rise in the agricultural value added as a proportion of GDP results in a 0.0703% rise in unemployment around the mean values since the random effects model's agriculture variable's coefficient is significant at 10%. It reflects the fact that Africa's primary source of employment, agriculture, is losing ground quickly. The agricultural industry in Africa is plagued by a number of issues that have seriously hampered its development. In many places of Africa, subsistence agriculture is still very much in use. In this sector, mechanization is still quite low.

Finally, the findings indicate that there is an inverse link between FDI and unemployment, suggesting that an increase in FDI as a percentage of GDP has an impact on employment development in SSA nations. This matches our a priori prediction, and it held true across all three models. A 1% increase in foreign direct investment reduces unemployment by 0.013%, ceteris paribus, according to elasticities calculated at the means. At a 1% level of significance, the coefficient is statistically significant. This outcome is consistent with research done by Folawewo and Adeboje in 2017. Investment inflows have the propensity to increase employment possibilities and lower unemployment rates, however it should be emphasized that these advantages depend on the type of FDI inflow, the type of production technology used in the sector, and the industry's general characteristics (Folawewo and Adeboje, 2017).

There is little doubt that foreign direct investment (FDI) may help the economy thrive and create jobs, but it's important to know what kinds of FDI are most effective at doing so. When compared to Brownfield investments, which have been shown to have zero or negative effects on employment growth, Greenfield investments are seen to have far more noticeable and beneficial effects on employment (Strat et al., 2015). The majority of foreign direct investment (FDI) into many African nations has been centered on natural resources, which is a prime example of a Brownfield investment with very weak elasticity of labor employment, according to the research conducted by Jeppesen and Mainguy (2007).

Although Sub-Saharan Africa's unemployment rate tended to rise with the growth rates of the agricultural (AGRIC), manufacturing (MANU), and services (SERV) sectors which may be due to rural-urban migration, which hinders industry and agricultural operations in rural areas. The impact of the growth rates of the agricultural, manufacturing, and service sectors on the urban unemployment rate in Sub-Saharan Africa was evaluated by model two's short-run economic

criterion estimation. It was found that MANU had a tendency to have a lower unemployment rate during the study period than the AGRIC and SERV sectors. The youth in Sub-Saharan Africa were preferred white-collar occupations rather than agriculture, whose yield was dependent on harvest seasons, which is just one of several factors that could explain this conclusion. Again, the service industry (which includes retail, banking, hotels, real estate, education, healthcare, social work, recreation, media, communications, energy, and water supply) faces problems with poor compensation, late payments, and giving recruitment certificates priority.

In addition, the spread of the manufacturing sector (including the production of food, beverages, tobacco, textiles, leather, and apparel, wood, paper, and printing, chemicals, plastics, rubber, nonmetallic minerals, primary metal, fabricated metal, machinery, and computer and electronics) may help to create jobs while population pressure in Sub-Saharan countries may also be a factor in the low employment in the AGRIC and SERV sectors.

Empirical findings from this study were mostly in agreement with those from some of the literatures reviewed, despite some differences in approach. The growth of the agricultural and industrial sectors, as stated by Ogbanga (2018) and Ewubare and Obayori (2015), contributed to the creation of jobs in Nigeria. However, recent studies have shown that agricultural growth has not contributed to the reduction of unemployment in several Sub-Saharan countries. The industrial and service sectors in Turkey were found to have stronger labour flexibility than other sectors by Duruel and Kara (2016). The research conducted for this study found that Sub-Saharan Africa met the criteria for the manufacturing sector, whereas the converse was true for the services sector. Administrative, political, and socioeconomic orientational values may be to blame for the departure. Using model three's short-run economic criterion estimation, which looked at how the unemployment rate in Sub-Saharan Africa was affected by economic growth.

CHAPTER SIX

SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

6.1 Introduction

In section 6.2 of this chapter, the study's findings are summarized, along with some related conclusions. After that, in section 6.3, some policy suggestions are made in light of the study's findings. Section 6.4 then analyses the study's weaknesses and identifies areas in need of additional investigation.

6.2 Summary and Conclusion

Examining the link between economic growth and unemployment in Sub-Saharan Africa from 2000 to 2021 was the study's main objective. The study used both static panel data estimation methodologies (Random effect and fixed effect models) to estimate a balanced panel data. The RE model was preferred in our static estimations above the FE model. The analysis made use of the Granger causality test, the cointegration test, and the VECM (vector error correction model). In the study, variables including GDP—a widely used proxy for economic growth—the unemployment rate (UNEMP), FDI, trade openness (TRADE), inflation (INF), the agricultural sector (AGRIC), the manufacturing sector (MANU), and the service sector (SERV) were all used.

AGRIC, MANU, and SERV variables are stationary at first difference, while GDP, UNEMP, FDI, TRADE, and INF variables are stationary at levels. This indicates that regression on these variables will not produce erroneous results. To achieve the study's goals and objectives, the Johansen Cointegration test was utilised, and its results showed the existence of a long-term relationship between the variables. According to the results of the vector error correction model (VECM), the effect of economic growth (GDP) on unemployment is negative and insignificant (UNEMP). To

determine the short-term relationship, the study also assessed the granger causality between the variables.

The first objective is met because the findings from all three estimations show a negative correlation between unemployment and economic growth in SSA. Regarding the second aim, which looks at how the growth rates of the agricultural, manufacturing, and service sectors affect the unemployment rate in Sub-Saharan Africa, we find that economic growth has a significant impact on the rates of unemployment. It was discovered that MANU tended to have a lower unemployment rate than the AGRIC and SERV sectors during the study period. One of several aspects that could explain is that young people in Sub-Saharan Africa preferred white-collar jobs over agriculture, whose output was dependent on harvest seasons.

On the basis of the findings, the study recommends that the government reduce taxes on individuals and corporations in order to increase investment spending to stimulate economic growth and therefore generate employment. The study advises that the government upgrade the agricultural sector and add modern equipment to the facilities in order to make agriculture more appealing to all citizens, regardless of qualification or occupation, in order to absorb the growing number of unemployed workers. This alone would significantly reduce the unemployment rate in the country. Similar to this, government should look for ways to diversify the economy in order to improve job opportunities and the national economy.

However, in order to achieve a growth rate that will be advantageous to the economy and raise the demand for labor through the creation of jobs, policymakers should adopt methods that support and encourage rapid and sustainable economic growth. The government should establish a monitoring team to make sure that funds supplied by the government to all sectors of the economy are effectively allocated to productive projects. This will deter dishonest public servants and

politicians from using public monies for their own benefit instead of programmes or initiatives that will promote national development. In addition, government spending should favor domestic production to tame inflation and accompanying economic shocks.

6.3 Policy Recommendations

The main inference made from the findings in the chapter before is that economic growth has a negative impact on unemployment. The latter's impact of economic growth is bigger in scope, though. This suggests that for nations in the SSA region, continued economic growth would be a crucial weapon for tackling the unemployment issue. Therefore, SSA countries should improve factors that affect economic growth such as trade, foreign direct investment, and inflation.

In the global economy, there is a need to increase the participation of SSA nations in international trade. Despite the fact that trade openness has been scientifically shown to aid lower unemployment, the region's participation in the global economy is quite moderate. Since the majority of African countries still face significant tariff and non-tariff barriers, attempts to boost trade should also concentrate on removing these barriers. According to Ackah and Morrissey (2005), more efforts should be taken to raise exports, especially given the fact that major liberalization has improved imports as a share of GDP but hasn't consistently increased exports. Despite these findings, SSA governments should refrain from boosting trade through the introduction of unneeded distortions in order to create jobs for citizens.

Based on the findings, this study recommended that government work with local communities to acquire large tracts of land that could be left to beneficiaries for commercial agriculture and that government should refocus on the growth of the manufacturing and merchandise sectors, which were the centre of industrialization and marketing.

6.4 Limitations of the Study

Due to a lack of data for several SSA countries, this study did not consider other important variables, such as labour market institutions (unemployment benefits, employment protection legislation, among others) in the estimations. These factors have been identified in the research as having a significant effect on unemployment in the context of the economic-unemployment nexus.

Additionally, the study did not compare the link between economic growth and unemployment across the several sub-regions or do comprehensive nation assessments for each of the countries in the region (East Africa, West Africa, Central Africa, and Southern Africa). Additionally, using oil as a proxy for oil-exporting and non-exporting nations may result in disparities in economic growth.

Future research on economic growth and unemployment nexus in sub-Saharan Africa should take into account these areas as they would significantly contribute to the body of literature already available.

REFERENCES

Abdul-Khaliq, Soufan, & Shihab (2014). Relationship between economic growth and unemployment rate in Arab countries. Journal of Economics and Sustainable Development.

Adarkwa, Samuel & Donkor, Francis. (2017). The Impact of Economic Growth on Unemployment in Ghana: Which Economic Sector Matters Most?

Al-Habees, M.A. and Rumman, M.A., 2012. The relationship between unemployment and economic growth in Jordan and some Arab countries. World Applied Sciences Journal, 18(5), pp. 673-680.

Anyanwu, J. C. (2014). Does Intra-African Trade Reduce Youth Unemployment in Africa? African Development Bank.

Baah-Boateng, W. (2014). Determinants of unemployment in Ghana. African Development Review, 25 (4), 385-399.

Baah-Boateng, W. (2016). The youth unemployment challenge in Africa: What are the drivers? The Economic and Labour Relations Review, 27 (4), 413-431.

Ball, Laurence, Davide Furceri, Daniel Leigh, and Prakash Loungani (2019). "Does one law fit all? Cross-country evidence on Okun's Law". In: Open Economies Review 30.5, pp. 841–874.

BARRO, R.J. (1991), "Economic growth in a cross section of countries", Quarterly Journal of Economics,106(2), pp.407-433, May.

Barro R. J (1993), "Losers and Winners in Economic Growth" In: Proceedings of the 1993, World Bank Annual Conference on Development Economics.

Barro, R. J. Determinants of economic growth: a cross-country empirical study. Cambridge, MA:

MIT Press,1997.

Boumphrey, S. (SEPTEMBER 22ND, 2014). Sub-Saharan Africa's Top 5 Economies. Euromonitor International.

Carree MA, Thurik AR. The impact of entrepreneurship on economic growth. Handbook of Entrepreneurship Research. 2010; 557-597

Christopoulos, D. K (2004). The relationship between output and unemployment: Evidence from Greek regions. Papers in Regional Science, 83(3), 611-620.

Ebaidalla, E.M. (2016). Analysis of youth unemployment in Sub-Saharan Africa: Determinants and possible ways forward. African Journal of Economic and Sustainable Development, 5 (4), 302-317.

Folawewo, A. O. & Adeboje, O.M. (2017). Macroeconomic determinants of unemployment: Empirical evidence from Economic Community of West African States. African Development Review, 29 (2), 197-210.

Farsio, F. & Quande, S. (2003). "An empirical analysis of the relationship between GDP and unemployment". Humanomics, 19:1-6.

Gaber, A. (2018). Determinants of unemployment: Empirical evidence from Palestine. Munich Personal RePEc Archive paper number 89424, 1-10.

Gruchelski M. (2012): Unemployment in the process of economic growth. Printing house SGH, Warsaw.

https://www.statista.com/statistics/1286939/unemployment-rate-in-africa-by-country/

International Labour Organization (2020). Report on employment in Africa (Re-Africa): Tackling the youth employment challenge.

Kerckhoffs, C.; Neubourg, C. D. & Palm, F. (1994). The determinants of unemployment and jobsearch duration in the Netherlands. De Economist, 142 (1), 21-42.

Khumalo, Z. Z. & Eita, J.H. (2015). Determinants of unemployment in Swaziland. Journal of Applied Sciences, 15 (9), 1190-1195.

Kyei, K. A. & Gyekye, K. B. (2011). Determinants of unemployment in Limpopo province in South Africa: Exploratory studies. Journal of Emerging Trends in Economics and Management Sciences, 2 (1), 54-61.

Lee, J., (2000)," The Robustness of the Okun's law: Evidence from OECD countries" Journal of Macroeconomics. 22: 331-356.

Kemi & Dayo (2014). Unemployment and Economic Growth in Nigeria.

Madito and Khumalo (2014). Economic Growth and unemployment nexus in South-Africa.

Mankiw G.N. (2009): Macroeconomics. Worth Publishers, New York.

Maqbool, M. S.; Mahmood, T. Sattar & Bhali, M. N. (2013). Determinants of unemployment: Empirical evidences from Pakistan. Pakistan Economic and Social Review, 51 (2), 191-208.

Martins, P. (2013). Growth, Employment and Poverty in Africa: Tales of Lions and Cheetahs – Background Paper for the World Development Report 2013. Overseas Development Institute.

Oh, W. & Lee, K., 2004. Causal Relationship Between Energy Consumption and GDP Revisited: The Case of Korea 1970-1999, Seoul: Energy Economics.

Okun A.M. (1962): Potential GNP: Its Measurement and Significance. In: Proceedings of the Business and Economic Statistics Section of the American Statistical Association. American Statistical Association, Washington, DC.

Riaz, A. & Zafar, F. (2018). Determinants of unemployment in less developing countries. SHS Web of Conferences, 48 (15), 1-6.

Soylu, Ö.B., Çakmak, İ. and Okur, F., 2018. Economic growth and unemployment issue: Panel data analysis in Eastern European Countries. Journal of International Studies, Vol 11(1).

UNSDS (2015) United Nations sustainable development summit. 25–27 September 2015, New York. https://sustainabledevelopment.un.org/post2015/summit

Zagler (2003). The Dynamics of Economic Growth and Unemployment in Major European Countries: Analysis of the Okun's Law. Applied Econometrics and International Development.

APENDICES

Unit Root Test

ECONOMIC GROWTH (GDP)

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.489529	0.0000
Test critical values:	1% level	-3.442746	
	5% level	-2.866900	
	10% level	-2.569686	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/26/22 Time: 06:33
Sample (adjusted): 14 572
Included observations: 518 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.644645	0.099336	-6.489529	0.0000
D(GDP(-1))	-0.091986	0.097326	-0.945134	0.3450
D(GDP(-2))	0.015347	0.094633	0.162170	0.8712
D(GDP(-3))	0.069149	0.089948	0.768764	0.4424
D(GDP(-4))	0.065952	0.085643	0.770072	0.4416
D(GDP(-5))	0.173152	0.081129	2.134278	0.0333
D(GDP(-6))	0.147336	0.077369	1.904313	0.0574
D(GDP(-7))	0.059124	0.075003	0.788281	0.4309
D(GDP(-8))	0.017200	0.072522	0.237173	0.8126
D(GDP(-9))	0.016822	0.067359	0.249742	0.8029
D(GDP(-10))	-0.008957	0.061748	-0.145053	0.8847
D(GDP(-11))	0.125409	0.055389	2.264161	0.0240
D(GDP(-12))	0.075390	0.044394	1.698182	0.0901
C	2.608494	0.445447	5.855904	0.0000

R-squared	0.386348	Mean dependent var	-0.016058
Adjusted R-squared	0.370519	S.D. dependent var	5.172626
S.E. of regression	4.103952	Akaike info criterion	5.688433
Sum squared resid	8488.581	Schwarz criterion	5.803297
Log likelihood	-1459.304	Hannan-Quinn criter.	5.733437
F-statistic	24.40861	Durbin-Watson stat	1.993902
Prob(F-statistic)	0.000000		

Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.547221	0.0000
Test critical values:	1% level	-3.975871	
	5% level	-3.418519	
	10% level	-3.131768	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/26/22 Time: 06:36
Sample (adjusted): 14 572
Included observations: 518 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.654799	0.100012	-6.547221	0.0000
D(GDP(-1))	-0.083256	0.097841	-0.850935	0.3952
D(GDP(-2))	0.023416	0.095087	0.246262	0.8056
D(GDP(-3))	0.076526	0.090349	0.847008	0.3974
D(GDP(-4))	0.072682	0.085995	0.845185	0.3984
D(GDP(-5))	0.179245	0.081435	2.201080	0.0282
D(GDP(-6))	0.153185	0.077665	1.972381	0.0491
D(GDP(-7))	0.063737	0.075198	0.847594	0.3971
D(GDP(-8))	0.020710	0.072644	0.285094	0.7757
D(GDP(-9))	0.019467	0.067438	0.288660	0.7730
D(GDP(-10))	-0.006680	0.061814	-0.108062	0.9140
D(GDP(-11))	0.126969	0.055428	2.290698	0.0224
D(GDP(-12))	0.076413	0.044419	1.720288	0.0860
C	2.344635	0.535409	4.379151	0.0000
@TREND("1")	0.001004	0.001130	0.888679	0.3746

R-squared	0.387310	Mean dependent var	-0.016058
Adjusted R-squared	0.370257	S.D. dependent var	5.172626
S.E. of regression	4.104808	Akaike info criterion	5.690725
Sum squared resid	8475.274	Schwarz criterion	5.813794
Log likelihood	-1458.898	Hannan-Quinn criter.	5.738944
F-statistic	22.71210	Durbin-Watson stat	1.994151
Prob(F-statistic)	0.000000		

UNEMPLOYMENT (UNEMP)

Null Hypothesis: UNEMP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.567272	0.0002
Test critical values:	1% level	-3.441573	
	5% level	-2.866383	
	10% level	-2.569409	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEMP)
Method: Least Squares
Date: 09/26/22 Time: 06:37
Sample (adjusted): 2 572
Included observations: 571 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEMP(-1)	-0.070431	0.015421	-4.567272	0.0000
C	0.577768	0.178046	3.245044	0.0012

R-squared	0.035364	Mean dependent var	0.004778
Adjusted R-squared	0.033669	S.D. dependent var	3.071070
S.E. of regression	3.018927	Akaike info criterion	5.051177
Sum squared resid	5185.822	Schwarz criterion	5.066404
Log likelihood	-1440.111	Hannan-Quinn criter.	5.057117
F-statistic	20.85998	Durbin-Watson stat	1.953267
Prob(F-statistic)	0.000006		

Null Hypothesis: GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 12 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.547221	0.0000
Test critical values:	1% level	-3.975871	
	5% level	-3.418519	
	10% level	-3.131768	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 09/26/22 Time: 06:36
Sample (adjusted): 14 572
Included observations: 518 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.654799	0.100012	-6.547221	0.0000
D(GDP(-1))	-0.083256	0.097841	-0.850935	0.3952
D(GDP(-2))	0.023416	0.095087	0.246262	0.8056
D(GDP(-3))	0.076526	0.090349	0.847008	0.3974
D(GDP(-4))	0.072682	0.085995	0.845185	0.3984
D(GDP(-5))	0.179245	0.081435	2.201080	0.0282
D(GDP(-6))	0.153185	0.077665	1.972381	0.0491
D(GDP(-7))	0.063737	0.075198	0.847594	0.3971
D(GDP(-8))	0.020710	0.072644	0.285094	0.7757
D(GDP(-9))	0.019467	0.067438	0.288660	0.7730
D(GDP(-10))	-0.006680	0.061814	-0.108062	0.9140
D(GDP(-11))	0.126969	0.055428	2.290698	0.0224
D(GDP(-12))	0.076413	0.044419	1.720288	0.0860
C	2.344635	0.535409	4.379151	0.0000
@TREND("1")	0.001004	0.001130	0.888679	0.3746

R-squared	0.387310	Mean dependent var	-0.016058
Adjusted R-squared	0.370257	S.D. dependent var	5.172626
S.E. of regression	4.104808	Akaike info criterion	5.690725
Sum squared resid	8475.274	Schwarz criterion	5.813794
Log likelihood	-1458.898	Hannan-Quinn criter.	5.738944
F-statistic	22.71210	Durbin-Watson stat	1.994151
Prob(F-statistic)	0.000000		

Null Hypothesis: UNEMP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.596736	0.0011
Test critical values:	1% level	-3.974208	
	5% level	-3.417709	
	10% level	-3.131288	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEMP)
Method: Least Squares
Date: 09/26/22 Time: 06:39
Sample (adjusted): 2 572
Included observations: 571 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEMP(-1)	-0.071958	0.015654	-4.596736	0.0000
C	0.461506	0.268616	1.718087	0.0863
@TREND("1")	0.000450	0.000778	0.578304	0.5633

R-squared	0.035932	Mean dependent var	0.004778
Adjusted R-squared	0.032537	S.D. dependent var	3.071070
S.E. of regression	3.020694	Akaike info criterion	5.054091
Sum squared resid	5182.770	Schwarz criterion	5.076932
Log likelihood	-1439.943	Hannan-Quinn criter.	5.063002
F-statistic	10.58501	Durbin-Watson stat	1.951440
Prob(F-statistic)	0.000031		

FOREIGN DIRECT INVESTMENT (FDI)

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 15 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.468854	0.0104
Test critical values:	1% level	-3.481217	
	5% level	-2.883753	
	10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 09/26/22 Time: 06:40
Sample (adjusted): 17 571
Included observations: 130 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.447234	0.128928	-3.468854	0.0007
D(FDI(-1))	-0.188952	0.129462	-1.459522	0.1472
D(FDI(-2))	-0.020902	0.139759	-0.149557	0.8814
D(FDI(-3))	0.073026	0.134527	0.542840	0.5883
D(FDI(-4))	0.103711	0.130695	0.793529	0.4291
D(FDI(-5))	0.295950	0.126260	2.343979	0.0208
D(FDI(-6))	0.061418	0.126778	0.484457	0.6290
D(FDI(-7))	0.279366	0.135073	2.068257	0.0409
D(FDI(-8))	0.198457	0.141514	1.402380	0.1635
D(FDI(-9))	0.171200	0.159165	1.075608	0.2844
D(FDI(-10))	0.174874	0.133165	1.313213	0.1918
D(FDI(-11))	0.040371	0.142373	0.283556	0.7773
D(FDI(-12))	0.176731	0.147610	1.197284	0.2337
D(FDI(-13))	0.297517	0.145350	2.046901	0.0430
D(FDI(-14))	-0.123141	0.138930	-0.886355	0.3773
D(FDI(-15))	-0.136709	0.133686	-1.022612	0.3087
C	0.753381	0.466998	1.613241	0.1095

R-squared	0.474601	Mean dependent var	-0.337907
Adjusted R-squared	0.400208	S.D. dependent var	4.089329
S.E. of regression	3.167032	Akaike info criterion	5.264859
Sum squared resid	1133.401	Schwarz criterion	5.639844
Log likelihood	-325.2158	Hannan-Quinn criter.	5.417228
F-statistic	6.379655	Durbin-Watson stat	2.178306
Prob(F-statistic)	0.000000		

Null Hypothesis: FDI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 17 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.253022	0.9907
Test critical values:	1% level	-4.080021	
	5% level	-3.468459	
	10% level	-3.161067	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 09/26/22 Time: 06:42
Sample (adjusted): 19 571
Included observations: 78 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.055851	0.220737	-0.253022	0.8011
D(FDI(-1))	-0.519216	0.207142	-2.506572	0.0150
D(FDI(-2))	-0.285642	0.191971	-1.487944	0.1422
D(FDI(-3))	-0.116520	0.200796	-0.580290	0.5640
D(FDI(-4))	0.056044	0.207754	0.269760	0.7883
D(FDI(-5))	0.104820	0.193610	0.541396	0.5903
D(FDI(-6))	0.010562	0.200497	0.052678	0.9582
D(FDI(-7))	-0.015528	0.213843	-0.072615	0.9424
D(FDI(-8))	0.013412	0.204087	0.065717	0.9478
D(FDI(-9))	-0.138484	0.205387	-0.674260	0.5028
D(FDI(-10))	0.134020	0.231431	0.579093	0.5648
D(FDI(-11))	-0.154317	0.222121	-0.694743	0.4900
D(FDI(-12))	-0.115923	0.215673	-0.537493	0.5930
D(FDI(-13))	0.281407	0.203002	1.386232	0.1710
D(FDI(-14))	-0.411740	0.238370	-1.727315	0.0894
D(FDI(-15))	-0.379818	0.217295	-1.747938	0.0858
D(FDI(-16))	0.078044	0.237969	0.327958	0.7441
D(FDI(-17))	-0.241637	0.200061	-1.207817	0.2320
C	0.071475	0.796771	0.089706	0.9288
@TREND("1")	-0.000594	0.002030	-0.292395	0.7710

R-squared	0.680210	Mean dependent var	-0.304197
Adjusted R-squared	0.575451	S.D. dependent var	4.222625
S.E. of regression	2.751354	Akaike info criterion	5.078618
Sum squared resid	439.0570	Schwarz criterion	5.682902
Log likelihood	-178.0661	Hannan-Quinn criter.	5.320524
F-statistic	6.493100	Durbin-Watson stat	2.062629
Prob(F-statistic)	0.000000		

TRADE

Null Hypothesis: TRADE has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on AIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.945202	0.0000
Test critical values:	1% level	-3.444923	
	5% level	-2.867859	
	10% level	-2.570200	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TRADE)
Method: Least Squares
Date: 09/26/22 Time: 06:43
Sample (adjusted): 6 571
Included observations: 442 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TRADE(-1)	-0.078695	0.015913	-4.945202	0.0000
D(TRADE(-1))	-0.069528	0.049040	-1.417768	0.1570
D(TRADE(-2))	-0.029793	0.045951	-0.648357	0.5171
D(TRADE(-3))	-0.246326	0.044793	-5.499192	0.0000
D(TRADE(-4))	0.064512	0.047737	1.351412	0.1773
C	4.937587	1.102430	4.478820	0.0000

R-squared	0.153814	Mean dependent var	-0.118676
Adjusted R-squared	0.144110	S.D. dependent var	10.75668
S.E. of regression	9.951475	Akaike info criterion	7.446800
Sum squared resid	43177.88	Schwarz criterion	7.502338
Log likelihood	-1639.743	Hannan-Quinn criter.	7.468706
F-statistic	15.85059	Durbin-Watson stat	2.032481
Prob(F-statistic)	0.000000		

Null Hypothesis: TRADE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on AIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.936049	0.0003
Test critical values:	1% level	-3.978956	
	5% level	-3.420022	
	10% level	-3.132657	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TRADE)
Method: Least Squares
Date: 09/26/22 Time: 06:43
Sample (adjusted): 6 571
Included observations: 442 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TRADE(-1)	-0.078835	0.015971	-4.936049	0.0000
D(TRADE(-1))	-0.069101	0.049216	-1.404046	0.1610
D(TRADE(-2))	-0.029512	0.046059	-0.640756	0.5220
D(TRADE(-3))	-0.246110	0.044878	-5.484020	0.0000
D(TRADE(-4))	0.064512	0.047791	1.349869	0.1778
C	4.841212	1.348952	3.588868	0.0004
@TREND("1")	0.000355	0.002858	0.124257	0.9012

R-squared	0.153844	Mean dependent var	-0.118676
Adjusted R-squared	0.142173	S.D. dependent var	10.75668
S.E. of regression	9.962730	Akaike info criterion	7.451290
Sum squared resid	43176.35	Schwarz criterion	7.516084
Log likelihood	-1639.735	Hannan-Quinn criter.	7.476846
F-statistic	13.18157	Durbin-Watson stat	2.033055
Prob(F-statistic)	0.000000		

INFLATION (INF)

Null Hypothesis: INF has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.892824	0.0000
Test critical values:	1% level	-3.445093	
	5% level	-2.867934	
	10% level	-2.570240	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 09/26/22 Time: 06:44
Sample (adjusted): 7 572
Included observations: 437 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.571763	0.072441	-7.892824	0.0000
D(INF(-1))	0.225871	0.069997	3.226880	0.0013
D(INF(-2))	-0.080810	0.065741	-1.229204	0.2197
D(INF(-3))	0.001162	0.059783	0.019443	0.9845
D(INF(-4))	0.027283	0.050898	0.536035	0.5922
D(INF(-5))	-0.006268	0.048066	-0.130414	0.8963
C	4.982049	1.361708	3.658676	0.0003

R-squared	0.302248	Mean dependent var	-0.081965
Adjusted R-squared	0.292512	S.D. dependent var	29.66787
S.E. of regression	24.95433	Akaike info criterion	9.287860
Sum squared resid	267768.9	Schwarz criterion	9.353214
Log likelihood	-2022.397	Hannan-Quinn criter.	9.313649
F-statistic	31.04420	Durbin-Watson stat	2.064584
Prob(F-statistic)	0.000000		

Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on AIC, maxlag=18)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.122333	0.0000
Test critical values:	1% level	-3.979197	
	5% level	-3.420139	
	10% level	-3.132726	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INF)
Method: Least Squares
Date: 09/26/22 Time: 06:45
Sample (adjusted): 7 572
Included observations: 437 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-1)	-0.601194	0.074017	-8.122333	0.0000
D(INF(-1))	0.247676	0.070819	3.497309	0.0005
D(INF(-2))	-0.061407	0.066417	-0.924569	0.3557
D(INF(-3))	0.015652	0.060145	0.260236	0.7948
D(INF(-4))	0.036937	0.051034	0.723774	0.4696
D(INF(-5))	0.001091	0.048105	0.022683	0.9819
C	1.502259	2.338632	0.642367	0.5210
@TREND("1")	0.013454	0.007361	1.827678	0.0683

R-squared	0.307639	Mean dependent var	-0.081965
Adjusted R-squared	0.296342	S.D. dependent var	29.66787
S.E. of regression	24.88669	Akaike info criterion	9.284680
Sum squared resid	265700.0	Schwarz criterion	9.359370
Log likelihood	-2020.703	Hannan-Quinn criter.	9.314154
F-statistic	27.23134	Durbin-Watson stat	2.064989
Prob(F-statistic)	0.000000		

Appendix C: Lag length criteria

VAR Lag Order Selection Criteria
Endogenous variables: GDP UNEMP FDI TRADE INF
Exogenous variables: C
Date: 09/26/22 Time: 07:09
Sample: 1 572
Included observations: 402

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-7569.330	NA	1.60e+10	37.68323	37.73294	37.70291
1	-5777.381	3530.407	2429187.	28.89244	29.19068*	29.01053
2	-5721.866	107.9905*	2087154.*	28.74063*	29.28741	28.95712*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix D: Johansen Cointegration test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.225992	144.9168	69.81889	0.0000
At most 1 *	0.077111	48.08346	47.85613	0.0476
At most 2	0.025783	17.75029	29.79707	0.5846
At most 3	0.015781	7.876326	15.49471	0.4787
At most 4	0.004918	1.863707	3.841465	0.1722

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.225992	96.83335	33.87687	0.0000
At most 1 *	0.077111	30.33316	27.58434	0.0216
At most 2	0.025783	9.873966	21.13162	0.7564
At most 3	0.015781	6.012619	14.26460	0.6116
At most 4	0.004918	1.863707	3.841465	0.1722

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

GDP	UNEMP	FDI	TRADE	INF
-0.393727	-0.054418	-0.005435	0.000123	0.030704
-0.088379	0.043078	0.244208	-0.013405	-0.045846
-0.018772	-0.147062	0.004426	0.025167	-0.076222
-0.031010	-0.006496	0.020772	0.019579	0.134144
0.057087	-0.061311	0.044240	-0.013436	0.097868

Unrestricted Adjustment Coefficients (alpha):

D(GDP)	1.659720	0.210798	-0.151808	-0.069972	-0.050145
D(UNEMP)	0.030126	-0.010112	0.105853	-0.021943	0.010158
D(FDI)	0.201497	-0.853492	-0.093342	-0.225416	0.010876
D(TRADE)	0.129532	0.675097	-0.615651	-1.008919	0.316882
D(INF)	0.791188	-0.646257	-0.206874	0.838172	0.882875

1 Cointegrating Equation(s): Log likelihood -5354.152

Normalized cointegrating coefficients (standard error in parentheses)

GDP	UNEMP	FDI	TRADE	INF
1.000000	0.138212	0.013805	-0.000312	-0.077983
	(0.04148)	(0.06029)	(0.00911)	(0.04679)

Adjustment coefficients (standard error in parentheses)

Vector Error Correction Estimates
Date: 09/26/22 Time: 09:52
Sample (adjusted): 3 571
Included observations: 402 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
GDP(-1)	1.000000
UNEMP(-1)	0.121469 (0.04310) [2.81836]
FDI(-1)	-0.075777 (0.06024) [-1.25788]
TRADE(-1)	0.002809 (0.00906) [0.31003]
INF(-1)	-0.062668 (0.04293) [-1.45981]
C	-5.033362

Error Correction:	D(GDP)	D(UNEMP)	D(FDI)	D(TRADE)	D(INF)
CointEq1	-0.676086 (0.06353) [-10.6425]	-0.001970 (0.01250) [-0.15764]	-0.044810 (0.06383) [-0.70207]	-0.221713 (0.18405) [-1.20463]	-0.183347 (0.25122) [-0.72982]
D(GDP(-1))	-0.078384 (0.05234) [-1.49756]	-0.007309 (0.01030) [-0.70986]	0.066142 (0.05259) [1.25776]	0.188118 (0.15164) [1.24054]	0.221505 (0.20699) [1.07015]
D(UNEMP(-1))	-0.272539 (0.25838) [-1.05478]	0.258633 (0.05083) [5.08826]	-0.263226 (0.25960) [-1.01397]	0.931233 (0.74859) [1.24398]	-0.139672 (1.02180) [-0.13669]
D(FDI(-1))	0.127928 (0.05343) [2.39426]	0.002179 (0.01051) [0.20730]	-0.198545 (0.05368) [-3.69850]	0.393167 (0.15480) [2.53982]	-0.058857 (0.21130) [-0.27855]
D(TRADE(-1))	0.035038 (0.01997) [1.75467]	-0.000971 (0.00393) [-0.24726]	0.002342 (0.02006) [0.11673]	-0.226890 (0.05785) [-3.92184]	0.070857 (0.07897) [0.89730]
D(INF(-1))	-0.065076 (0.01494) [-4.35450]	0.002091 (0.00294) [0.71118]	-0.000601 (0.01501) [-0.04001]	0.032114 (0.04330) [0.74171]	1.031681 (0.05910) [17.4568]
C	-0.402625 (0.18487) [-2.17791]	-0.003820 (0.03637) [-0.10504]	0.054644 (0.18574) [0.29420]	-0.050977 (0.53560) [-0.09518]	0.778439 (0.73107) [1.06479]
R-squared	0.355236	0.067501	0.040409	0.054239	0.474683
Adj. R-squared	0.345442	0.053337	0.025833	0.039873	0.466704
Sum sq. resids	5384.728	208.3819	5435.533	45198.47	84209.46
S.E. equation	3.692184	0.726326	3.709561	10.69703	14.60098
F-statistic	36.27126	4.765515	2.772272	3.775494	59.48791
Log likelihood	1091.982	438.3403	1093.870	1519.609	1644.680

Appendix E: VECM granger causality test

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 09/26/22 Time: 10:01
Sample: 1 572
Included observations: 402

Dependent variable: D(GDP)

Excluded	Chi-sq	df	Prob.
D(UNEMP)	1.112564	1	0.2915
D(FDI)	5.732469	1	0.0167
D(TRADE)	3.078871	1	0.0793
D(INF)	18.96165	1	0.0000
All	32.50717	4	0.0000

Dependent variable: D(UNEMP)

Excluded	Chi-sq	df	Prob.
D(GDP)	0.503903	1	0.4778
D(FDI)	0.042974	1	0.8358
D(TRADE)	0.061136	1	0.8047
D(INF)	0.505777	1	0.4770
All	1.018582	4	0.9070

Dependent variable: D(FDI)

Excluded	Chi-sq	df	Prob.
D(GDP)	1.581951	1	0.2085
D(UNEMP)	1.028130	1	0.3106
D(TRADE)	0.013626	1	0.9071
D(INF)	0.001601	1	0.9681
All	2.593208	4	0.6280

Dependent variable: D(TRADE)

Excluded	Chi-sq	df	Prob.
D(GDP)	1.538933	1	0.2148
D(UNEMP)	1.547479	1	0.2135
D(FDI)	6.450674	1	0.0111
D(INF)	0.550139	1	0.4583
All	9.932369	4	0.0416

Dependent variable: D(INF)

Excluded	Chi-sq	df	Prob.
D(GDP)	1.145215	1	0.2846
D(UNEMP)	0.018685	1	0.8913
D(FDI)	0.077590	1	0.7806
D(TRADE)	0.805153	1	0.3696
All	2.052928	4	0.7260