International Journal of Economics, Finance and Management Sciences
2026, Vol. 14, No. 3, pp. 195–207
https://doi.org/10.11648/j.ijefm.20261403.12

SciencePG
Science Publishing Group

Research Article

A Dynamic Panel Analysis of Unemployment Determinants in African Economies

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Abstract

Unemployment represents one of the most pressing economic challenges confronting countries worldwide, It affects not only developing countries but also developed countries. However, the factors influencing employment outcomes vary across regions, and African countries exhibit distinctive structural characteristics that shape their labor markets. The lack of consensus in the literature regarding the key determinants of unemployment in Africa, combined with the relative scarcity of empirical studies, makes it difficult to design effective policy responses. Therefore, This study seeks to identify and quantify the main economic factors influencing unemployment in African countries over the period 2001–2023. The analysis covers 34 countries and employs several panel data techniques, including Pooled OLS, Fixed Effects (FEM), Random Effects (REM), and the Dynamic Generalized Method of Moments (difference GMM). The investigation focuses on four principal economic determinants: Gross Domestic Product (GDP), inflation (INF), foreign direct investment (FDI), and the share of wage and salaried workers (WAGE). The study relied on the results of estimating the generalized dynamic Moments method, and The empirical findings reveal a negative relationship between unemployment and each of these variables. Among them, GDP exerts the strongest effect in reducing unemployment, followed by the share of wage and salaried workers, FDI, and inflation.

Keywords

Unemployment, GDP, Inflation, FDI, Wage and Salaried Workers, Africa, GMM

1. Introduction

Labor economics is concerned with studying how labor markets work and understanding and addressing many of the economic and social problems in modern societies. Among the most important topics it covers are income distribution, hiring and firing decisions, and the determinants of unemployment. It believes that there are three main parties in the labor market: workers, firms, and the government [1]. Unemployment is one of the most significant macroeconomic problems in all countries, and it is a global problem. The term unemployment refers to people who are willing, able, and seeking work to generate income but fail to find it. Thus, unemployment refers to people who are unemployed, available, and seeking work [2]. Unemployment indicates a decline in economic growth and economic performance, the underutilization of resources, and the economy not operating at full capacity. Consequently, unemployment has significant and serious

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Received: 2 May 2026; **Accepted:** 15 May 2026; **Published:** 26 May 2026

consequences, especially for developing countries [3]. The rising unemployment rate has become a concern for policymakers and researchers in both developing and developed economies. This is due to the importance of unemployment as a key outcome of the labor market and an indicator of the general economic situation [4]. Unemployment is often used as a measure of economic health, and the underutilization of human capital (unemployment) is an issue that negatively impacts a country's development [5].

Economists study unemployment to determine its causes and help improve public policies affecting the unemployed. One cause of unemployment is the time it takes to match workers to jobs. A second cause is wage stagnation, which is the failure of wages to adjust to a level at which labor supply equals labor demand [6]. There are several types of unemployment, including frictional unemployment, structural unemployment, cyclical unemployment, and seasonal unemployment.

The ILO's approach to defining unemployment is based on the labour force framework, which classifies the working-age population into three categories: employed, unemployed, and out of the labour force [7]. The unemployment rate is defined as the ratio of the unemployed to the total labor force, that is, to the total number of workers in the economy, whether employed or unemployed [8].

Samuelson and Nordhaus explain in their book that people who have jobs are the employed, people who are not working but looking for work are the unemployed, and people who are neither working nor looking for work are outside the labor force [9].

Unemployment is costly to individuals and families, as well as to the economy and society as a whole, as it represents a waste of scarce resources, resulting in lost income and potential production. Long periods of unemployment also erode the technical and social skills of unemployed individuals, reducing their employability. The longer an individual remains unemployed, the less attractive they become to a potential employer. Unemployment may therefore become persistent, causing a permanent loss of human capital and potential production [10].

In their study, Bell & Blanchflower highlighted the consequences of unemployment, including lost productivity. During long periods of unemployment, workers may lose their skills and thus their human capital. It causes individuals to feel unhappy, increases susceptibility to malnutrition, illness, loss of self-esteem, and depression, and increases the likelihood of adverse health outcomes such as heart attacks in later life. As unemployment rates rise, crime rates tend to rise. The effects of unemployment depend largely on the length of time an individual remains unemployed [11].

There is no agreement among economists on the economic determinants of unemployment, and the determinants of unemployment vary from place to place. For example, Eita & Ashipala focused in their study on the output gap, inflation, real wages, investment and productivity [12], while Folawewo & Adeboje focused on GDP, inflation, foreign direct investment, productivity, population growth and external debt [4].

There are numerous studies on the economic determinants of unemployment in Europe and America, while few studies have addressed the economic determinants of unemployment in Africa. Unemployment is hitting Africa hard. For example, in 2023, unemployment rates in Algeria were 11.7%, Mauritania 10.4%, Egypt 7.3%, Angola 14.5%, and South Africa 32.09%. Therefore, the study focuses on the determinants of unemployment in Africa during the period (2001-2023) and identifying which ones are most influential, with the aim of reducing unemployment.

The importance of the study stems from the importance of employment, as raising employment rates is a strategy for combating unemployment. Therefore, the study focuses on identifying the most important economic variables affecting unemployment in Africa and analyzing the relationship between these variables and unemployment. The study relied on variables such as gross domestic product, inflation, foreign direct investment, and wages and salaried workers. This is achieved by applied the Dynamic Generalized Method of Moments (GMM) to arrive at results and recommendations that will contribute to reducing unemployment and its various consequences.

The study is divided as follows: Section (2) Macroeconomic Determinants of Unemployment: A Review of the Literature, Section (3) Methodology, Section (4) Estimation Methods, and Section (5) Conclusions.

2. Macroeconomic Determinants of Unemployment: A Review of the Literature

Phillips aimed to determine whether statistical evidence supported the hypothesis that the rate of change in money wage rates could be explained by the level of unemployment and the rate of change in unemployment in the United Kingdom during the periods 1861–1913, 1913–1948 and 1948–1957, excluding years in or immediately following extremely rapid increases in import prices. He concluded that statistical evidence supported the study's hypothesis [13].

Okun studied the relationship between unemployment and gross national product (GNP) in the United States, using 55 quarterly observations from the second quarter of 1947 to the fourth quarter of 1960. He found a negative relationship between unemployment and GNP, with unemployment increasing by 0.3% from one quarter to the next if GNP remained unchanged. An increase in GNP leads to a 0.3% decrease in unemployment from one quarter to the next [14].

Maqbool, Abdul Sattar and Bhalli analyzed the determinants of unemployment in Pakistan during the period (1976-2012) using GDP, inflation, FDI, population and external debt. The results show that GDP, inflation, population and FDI are important determinants of unemployment in the Pakistan

economy during the study period. There is a negative relationship between unemployment and GDP, FDI, inflation and external debt, while there is a positive relationship between unemployment and population [15].

Özel, Sezgin and Topkaya investigated the relationship between economic growth and unemployment in seven industrialized countries (G7) during the period (2000–2011) using GDP and productivity. The comparison was made between the period before and after the global financial crisis. The results indicate a negative relationship between unemployment and both GDP and productivity. GDP and productivity significantly influence unemployment in the period before the global financial crisis [16].

Betul aimed to study the determinants of unemployment in the BRIC countries (Brazil, Russia, India, and China) during the period (2001-2012) using GDP, inflation, gross investment, population, trade volume and industrial production index. He concluded that inflation is the most important cause of unemployment in the BRIC countries, followed by population growth. There is a negative relationship between unemployment and GDP, trade volume, gross investment and industrial production growth during the study period [2].

Alrayes and Abu Wadi conducted a study to identify the determinants of unemployment in Bahrain during the period (1980-2015) using GDP, inflation, government spending and the gross fixed capital formation rate. They found a negative relationship between unemployment and GDP (insignificant), and a positive relationship between unemployment and inflation (insignificant). There is a negative relationship between unemployment and fixed capital formation (significant), as well as a negative relationship between unemployment and government spending (significant) [17].

Bayrak and Tatli aimed to identify the factors influencing youth employment in 31 OECD countries over the period (2000–2015), using the consumer price index, gross domestic savings, economic growth rate and labor productivity. The results indicate a negative relationship between unemployment and the economic growth rate, the consumer price index and gross domestic savings, while there is a positive relationship between unemployment and labor productivity during the study period [18].

Soylu, Çakmak, and Okur examined the relationship between economic growth and unemployment in 8 Eastern European countries (Belarus, Bulgaria, Czech Republic, Romania, Poland, Ukraine, Hungary, and Slovakia) over the period (1992–2014), using gross domestic product (GDP). They found a negative relationship between unemployment and GDP during the study period [19].

Siddiqa examined the determinants of unemployment in 10 developing countries (Pakistan, Iran, Malaysia, Oman, Nepal, Russia, the Philippines, Turkey, Uganda, and Brazil) over the period (2000-2019), using GDP, inflation, population, external debt, exchange rate, education spending, and remittances. The results indicate a negative relationship between unemployment and GDP, inflation, remittances, exchange rate, and education spending, while there is a positive relationship between unemployment and both population and external debt [3].

2.1. Macroeconomic Drivers of Unemployment in Africa

Eita and Ashipala investigated the causes of unemployment in Namibia over the period 1971–2007, using the output gap, inflation, real wages, investment and productivity. The study's results revealed a negative relationship between unemployment and inflation in Namibia. Unemployment responds positively if actual output is lower than potential output. There was a positive relationship between unemployment and wages during the study period, while there was an inverse relationship between unemployment and investment. The results also indicated that the Phillips curve holds for Namibia and that unemployment can be reduced by increasing aggregate demand [12].

Oniore, Bernard, and Gyang analyzed the macroeconomic determinants of unemployment in Nigeria over the period 1981–2014, using GDP, inflation, openness and private domestic investment. The results indicate a negative relationship between unemployment and both GDP and inflation. However, there is a positive relationship between unemployment and both openness and private domestic investment. There is a long run relationship between the variables [20].

Folawewo and Adeboje analyzed the relationship between macroeconomic aggregates and unemployment in the Economic Community of West African States (ECOWAS) over the period (1991-2014) using GDP, inflation, foreign direct investment, productivity, population growth and external debt. The results of the random effects indicate that there is a negative relationship between unemployment and each of GDP, foreign direct investment and external debt during the study period, while there is a positive relationship between unemployment and each of inflation, productivity and population growth [4].

Johnny, Timipere, Krokeme, and Markjackson investigated the impact of foreign direct investment (FDI) on unemployment in Nigeria during the period 1980–2015, using FDI and capital formation. They found a negative (insignificant) relationship between unemployment and FDI, while there was a positive (significant) relationship between unemployment and capital formation [21].

Tsaurai studied the macroeconomic factors that determined unemployment in Africa during the period (2001-2015). Three countries were selected from each African region (Burundi, Kenya, Rwanda, Algeria, Morocco, Tunisia, Nigeria, Ghana, Senegal, Gabon, Democratic Republic of Congo, Cameroon, Namibia, Mozambique, and South Africa). The study relied on variables such as information and communication technology (ICT), human capital development, financial development, foreign direct investment (FDI), trade openness, population growth, economic growth, and infrastructure development. It

also found that ICT, human capital development, and infrastructure development were insignificant determinants of unemployment [22].

Khalifa focused on studying regional unemployment factors in the Tunisian regions (Middle East, Midwest, Northeast, Northwest, Southeast, Southwest) during the period (2010-2020). The study relied on the Human Development Index, population, tourist numbers, and private sector output. It found an inverse relationship between unemployment and the Human Development Index, while there is a positive relationship between unemployment and each of the population, tourist numbers, and private sector output [23].

2.2. Unemployment Trends and Determinants in Egypt

Touny focused on studying the long-term inverse relationship between unemployment and inflation in Egypt during the period 1974–2011 using the Johansen-Juselius Cointegration test and the VECM error correction model. The VECM results showed a statistically significant negative error correction limit, indicating that changes in the inflation rate adjust to the long-run equilibrium level [24].

Omran and Bilan investigated the relationship between unemployment (UNEMP) and inflation (INF) in Egypt during the period 1980–2019 using the vector autoregressive (VAR) model and the impulse response function (IRF) tool. Their results indicate that inflation is positively correlated with GDP, while it negatively affects the unemployment rate [25].

Mohamed, Alkhaldi, and Alazmi studied the impact of foreign direct investment (FDI) on economic development indicators in Egypt, namely the GDP growth rate, national income (NI), inflation rate (INF), unemployment rate (UNemp), and gross capital formation (TCF), during the period 2005–2023. The results indicate a statistically significant positive relationship between FDI and both GDP and NIF. They also show that the relationship between FDI and both inflation and unemployment rates is consistent with economic theory, as increased investment leads to higher inflation and lower unemployment [26].

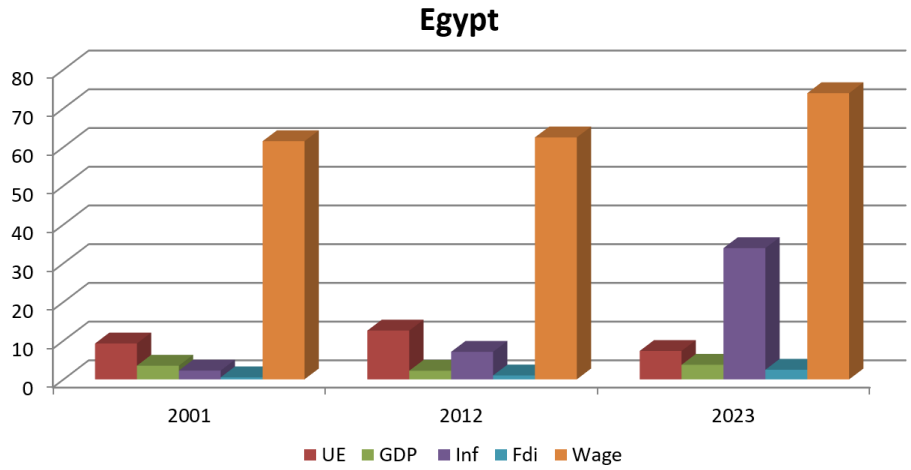

Figure 1. *The evolution of (UE, GDP, INF, FDI & WAGE) in Egypt during (2001-2012-2023).*

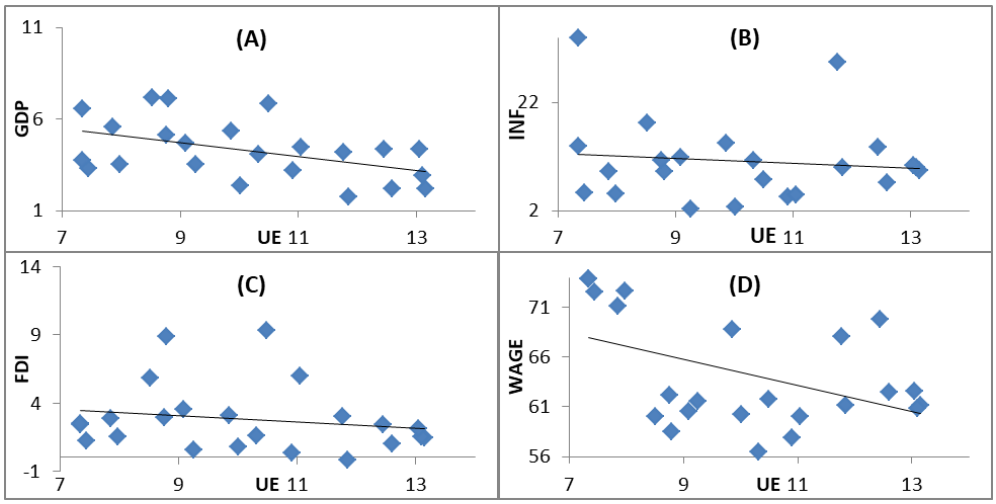

Figure 2. *The relationship between UE and (GDP, INF, FDI & WAGE) in Egypt during (2001: 2023).*

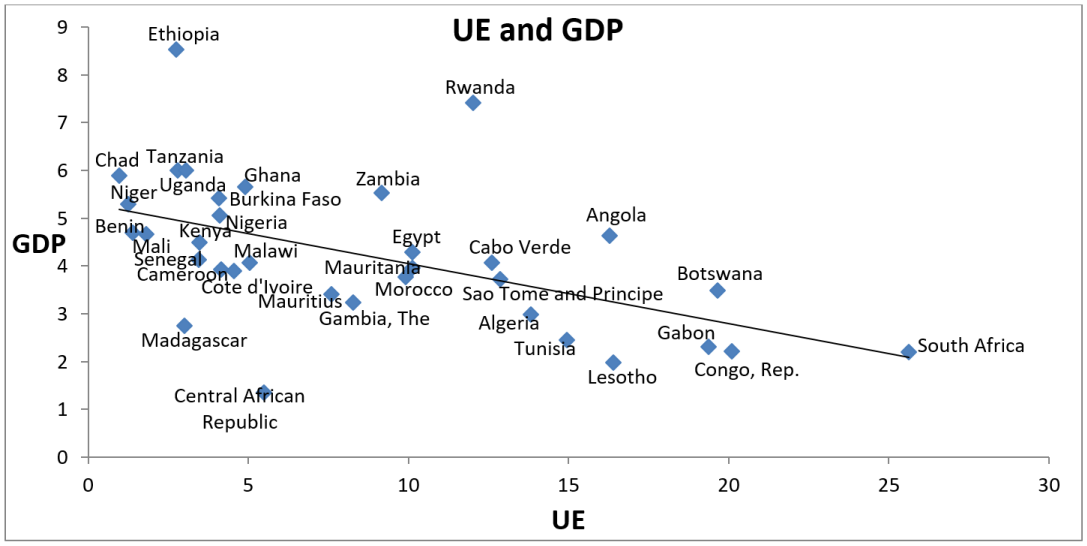

Figure 3. The relationship between UE and GDP (Africa).

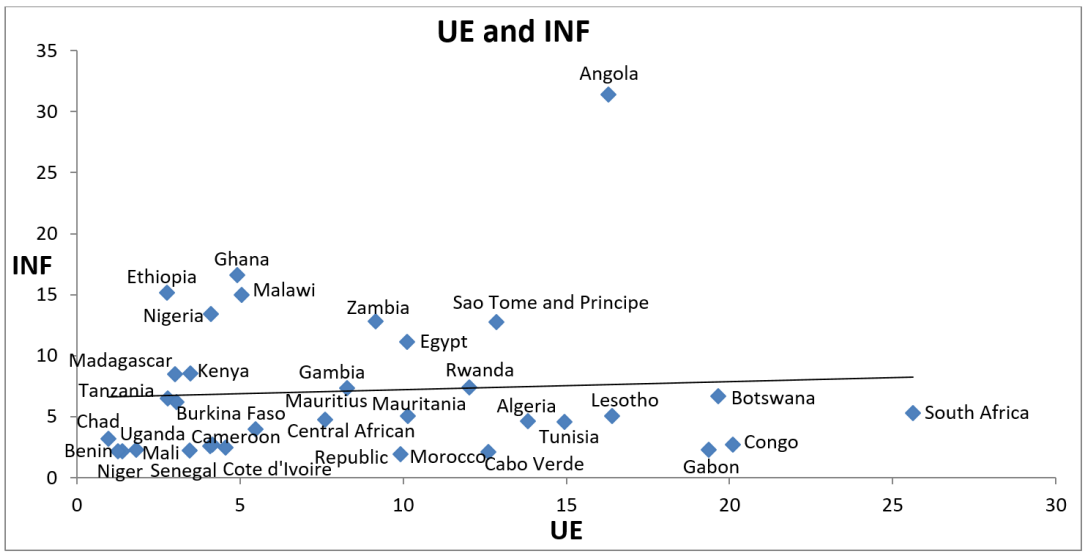

Figure 4. The relationship between UE and INF (Africa).

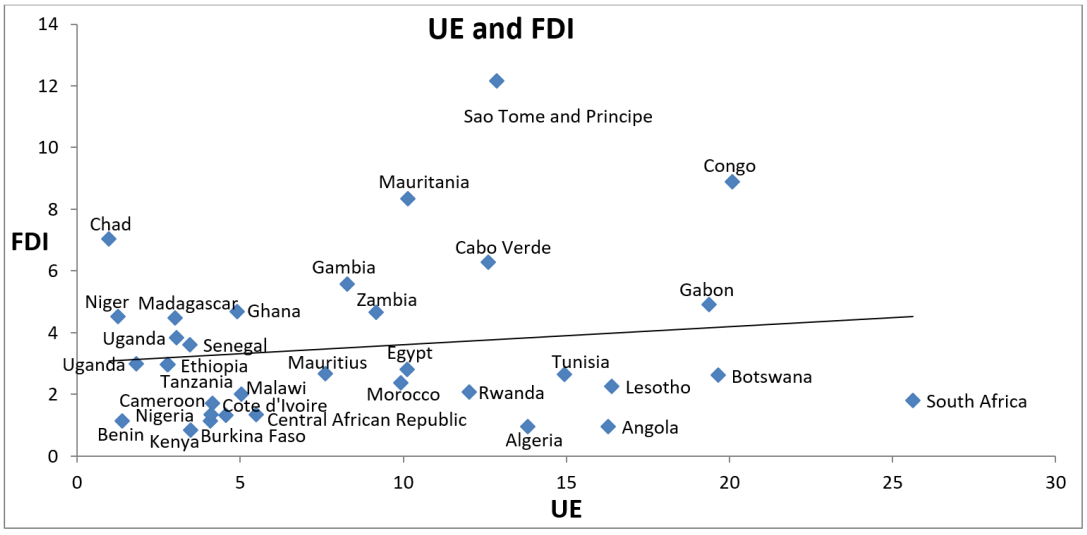

Figure 5. The relationship between UE and FDI (Africa).

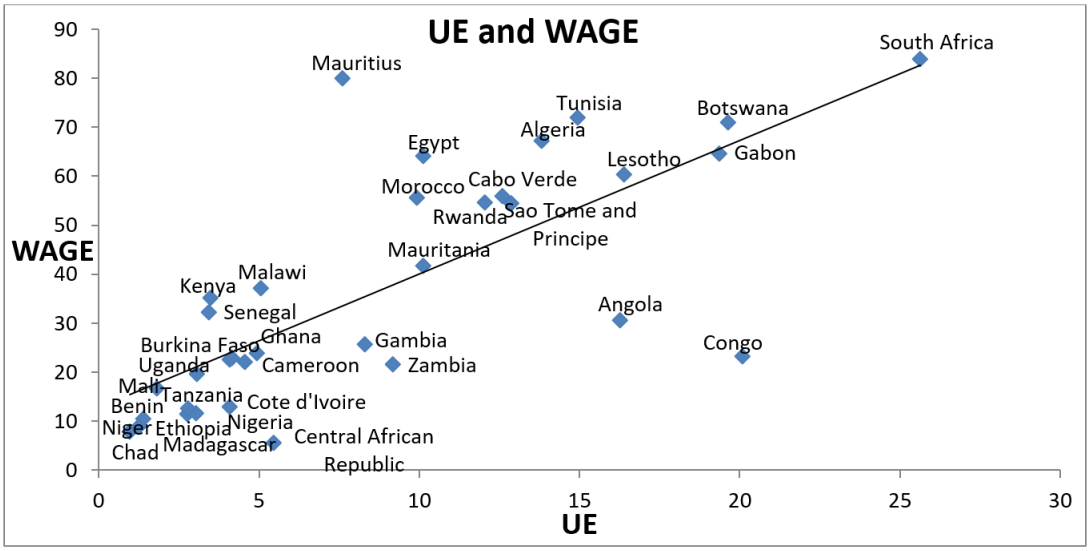

Figure 6. *The relationship between UE and WAGE (Africa).*

Figure 1 illustrates the evolution of the study variables (UE, GDP, INF, FDI & WAGE) in Egypt during (2001–2012-2023), Where (2001) represents the beginning of the study period, (2012) represents the middle of the period, and (2023) represents the end of the period. Figure 2 illustrates the relationship between UE and (GDP, INF, FDI & WAGE) in Egypt during (2001: 2023), where (A) shows the relationship between unemployment and GDP, (B) shows the relationship between unemployment and inflation, (C) shows the relationship between unemployment and foreign direct investment, and (D) shows the relationship between unemployment and Wage and salaried workers. Figure 3, 4, 5, and 6 illustrate the relationship between unemployment (UE) and each of the following: GDP, inflation (INF), foreign direct investment (FDI), and Wage and salaried workers (WAGE), respectively.

3. Methodology

3.1. Theoretical Framework

To study the economic determinants of unemployment in Africa, the study was guided by (Varian, 1976) as follows [27]:

Based on the standard Keynesian model, assuming that (y) is the real output, and the demand for real investment is constant at (I), and the demand for real consumption is represented by a linear consumption function (C(y) =cy), to achieve equilibrium in the output market the demand for output must be equal to the supply of output (demand for output = supply of output) [24]:

$$cy + I = y \quad (1)$$

$$y - cy = I \quad (2)$$

$$y(1 - c) = I \quad (3)$$

Then, the equilibrium output is represented by the following equation:

$$y = I/(1 - c) \quad (4)$$

Assuming (m) is a country producing output from labor using a standard neoclassical production function, in equilibrium, it must be:

$$mf(L) = y = I/(1 - c) \quad (5)$$

Where (L=ml) is the aggregate demand for labor, (N) is the aggregate supply of labor. If investment (I) is low, the demand for labor will be less than the supply of labor (L<N), and this is the case of unemployment. In Keynesian theory, unemployment results from insufficient aggregate demand.

Assuming that the labor market is competitive, and ($L_d(w)$) represents the demand for labor to maximize profit as a function of the real wage (w=W/P), then (w) must satisfy the following condition:

$$mf\left(L_d(w)\right) = y = I/(1 - c) \quad (6)$$

The previous equation (6) determines the equilibrium values between output, unemployment, and real wages in terms of external investment demand, and that unemployment is the result of insufficient effective demand.

Assuming there are (G) government jobs, (N) individuals in the labor force, (L) labor supply in the competitive sector, and (N-L) labor supply in the government sector, workers have two options: the first is to accept a job in the competitive sector with a wage (W_c), or the second is to search for or wait for a government job with a wage (W_g). Assuming (π) is the probability of obtaining a government job, in equilibrium, the expected benefit of the two strategies must be equal:

$$u(W_c/P) = \pi \ \ u(W_g/P) \quad (7)$$

Normalizing the unemployment benefit to zero, the equilibrium value of (π) must be the frequency of successful government employment. In equilibrium, it must be (π= G/ (N-L)), by inserting this into the previous equilibrium equation (7) and solving for (L), we obtain the labor supply function in the competitive sector:

$$L\left(W_c/P\,, W_g/P\right) = N - \frac{u(W_g/P)G}{u(W_c/P)} \quad (8)$$

By adding the equilibrium condition for the production market to the previous equation (8), we obtain:

$$mf\left(L_d(W_c/P)\right) = y = I/(1-c) \quad (9)$$

$$mL_d(W_c/P) = L(W_c/P\,, W_g/P) \quad (10)$$

From the above, we conclude that Keynesian unemployment results from a deficiency in effective aggregate demand, which occurs when the demand for labor is less than the labor supply. We can conclude from the last two equations (Nos. 9 and 10) that the demand for labor (which can be expressed as the unemployment rate) is affected by several factors, including (y) output, (P) price level, (I) investment and (W) wages. The equation can be formulated as follows:

$$L_d(w) = Y + P + I + W \quad (11)$$

Where (L_d(w)) is the demand for labor, which can be expressed as unemployment, (Y) output, which can be expressed as gross domestic product, (P) price level, which can be expressed as inflation, (I) investment, which can be expressed as Foreign direct investment, (W) wages, which can be expressed as wage and salaried workers, then the previous equation (11) can be formulated as follows:

$$UE = f(GDP, INF, FDI, WAGE) \quad (12)$$

The variables and their proxies were selected based on previous studies. Previous studies that were taken into consideration include Özel et al (2013), Maqbool et al (2015), Gur (2015), Bayrak & Tatli (2018), and Tsaurai (2020). Some previous studies used real wages as an independent variable in their study of the determinants of unemployment, but no study used the total number of wage and salaried workers, so the study aims to include it. So the model equation can be formulated as follows:

$$UE = \alpha_0 + \alpha_1 GDP + \alpha_2 INF + \alpha_3 FDI + \alpha_4 WAGE \quad (13)$$

By adding the logarithm to the variables in the previous equation:

$$log(UE) = \alpha_0 + \alpha_1 log(GDP) + \alpha_2 log(INF) + \alpha_3 log(FDI) + \alpha_4 log(WAGE) \quad (14)$$

Because the study data is panel data, the equation is formulated as follows:

$$log(UE)_{it} = \beta_0 + \beta_1 log(GDP)_{it} + \beta_2 log(INF)_{it} + \beta_3 log(FDI)_{it} + \beta_4 log(WAGE)_{it} + \varepsilon_{it} \quad (15)$$

Where $log(UE)_{it}$ denotes natural logarithm of the unemployment rate in country i during period t, $log(GDP)_{it}$ denotes natural logarithm of the GDP growth rate in country i during period t, $log(INF)_{it}$ denotes natural logarithm of the inflation rate in country i during period t, $log(FDI)_{it}$ denotes natural logarithm of foreign direct investment in country i during period t, $log(WAGE)_{it}$ denotes natural logarithm of wage and salaried workers in country i during period t, β_0 denotes constant term parameter, $\beta_1, \beta_2, \beta_3, \beta_4$: The variable parameters, and ε_{it}: Random error.

3.2. Data

To study the economic determinants of unemployment in Africa, the study uses panel data for 34 African countries over period (2001-2023). Countries of Study (Algeria, Angola, Benin, Botswana, Burkina Faso, Cabo Verde, Cameroon, Central African, Chad, Congo-Rep, Cote d'voire, Egypt, Ethiopia, Gabon, Gambia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia). The study is based on Pooled, Fixed Effect, Random Effect, and the generalized moments method (GMM). The choice of countries depends on data availability. The study uses data sources available from the World Bank https://databank.worldbank.org/source/world-development-indicators. Table 1 shows the 34 African countries included in the study.

Table 1. *The list of 34 African Countries.*

The list of 34 African Countries				
Algeria	Central African	Gambia, The	Mauritania	Senegal

The list of 34 African Countries				
Angola	Chad	Ghana	Mauritius	South Africa
Benin	Congo, Rep	Kenya	Morocco	Tanzania
Botswana	Cote d'voire	Lesotho	Niger	Tunisia
Burkina Faso	Egypt	Madagascar	Nigeria	Uganda
Cabo Verde	Ethiopia	Malawi	Rwanda	Zambia
Cameroon	Gabon	Mali	Sao Tome and Principe	

The dependent variable is the unemployment rate Log (UE). The independent variables are the gross domestic product Log (GDP), inflation Log (INF), foreign direct investment Log (FDI), and wage and salaried workers Log (WAGE). Table 2 describes the study variables, the proxy for each variable, and the source.

Table 2. *Data Description: UE, GDP, INF, FDI, and WAGE.*

Variable	Description	Proxy	Source
Unemployment (UE)	The share of the labor force that is without work but available for and seeking employment (% of total labor force).	Unemployment, total (% of total labor force) (modeled ILO estimate).	https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS
GDP Growth (GDP)	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 prices, expressed in U.S. dollars.	GDP growth (annual%).	https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG
Inflation (INF)	It is measured by the consumer price index.	Inflation, consumer prices (annual%).	https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG
Foreign Direct Investment (FDI)	The net inflows of investment.	Foreign direct investment, net inflows (% of GDP).	https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS
Wage and salaried workers (WAGE)	Workers who hold the type of jobs defined as "paid employment jobs (% of total employment).	Wage and salaried workers, total (% of total employment) (modeled ILO estimate).	https://data.worldbank.org/indicator/SL.EMP.WORK.ZS

Source: World Development Indicators. https://databank.worldbank.org/source/world-development-indicators

Table 3 shows the descriptive statistics for the variables included in the study. The table shows the mean, median, minimum, maximum, standard deviation, sum, and total number of observations for all variables. The statistics indicate that the mean value of Log (UE) in the study sample is (1.804) with a minimum value of (-1.152) and a maximum value of (3.526). The mean value of Log (GDP) in the study sample is (3.709) with a minimum value of (-0.497) and a maximum value of (4.257). The mean value of Log (INF) is (3.131) with a minimum value of (-1.963) and a maximum value of (5.133). The mean value of Log (FDI) is (3.045) with a minimum and maximum value of (-0.345) and (4.163) respectively. The mean value of Log (WAGE) is (3.345) with a minimum and maximum value of (1.659) and (4.452) respectively.

Table 3. Descriptive statistics of the variables for 34 African Countries.

	Mean	Median	Maximum	Minimum	Std. Dev	Sum	Obs
LNUE	1.804	1.830	3.527	-1.152	0.925	1410.984	782
LNGDP	3.710	3.722	4.257	-0.498	0.182	2901.081	782
LNINF	3.131	3.095	5.133	-1.964	0.330	2448.756	782
LNFDI	3.046	3.012	4.163	-0.345	0.229	2381.867	782
LNWAGE	3.345	3.340	4.453	1.659	0.755	2616.119	782

3.3. Unit Root Test

The study tests unit root for all variables using the Augmented Dickey-Fuller (ADF) Test, I'm, Pesaran, Shin Test, and Levin, Lin, Chu Test. Table 4 shows results of the unit root test for all study variables. These results indicate that all variables are stationary at level. The unemployment, GDP, and inflation series are stationary at level when including the trend and the intercept and when including the intercept only, as shown for all three tests. The foreign direct investment series is stationary at level when including the intercept only, according to the ADF Test, I'm, Pesaran, Shin Test. The series of wage workers is stationary at level when including the trend with the intercept for the Levin, Lin, Chu Test and when including the intercept only for ADF Test and Levin, Lin, Chu Test. (***, **, *) denote significance level at 1%, 5%, and 10%, respectively.

Table 4. ADF Test, I`m, Pesaran, Shin Test and Levin, Lin, Chu Test.

	Level					
	Trend &Intercept			Intercept		
	ADF	I`m, Pesaran, Shin	Levin, Lin, Chu	ADF	I`m, Pesaran, Shin	Levin, Lin, Chu
LNUE	116.671***	-3.822***	-3.579***	95.625**	-2.506***	-3.332***
LNGDP	186.808***	-8.118***	-7.115***	202.407***	-8.596***	-7.726***
LNINF	149.789***	-5.362***	-5.505***	198.923***	-8.064***	-6.048***
LNFDI	83.089	-1.067	1.175	114.366***	-2.909***	0.024
LNWAGE	62.604	1.131	-2.010**	94.702**	-0.678	-5.425***

4. Estimation Methods

The study investigates the economic determinants of unemployment in Africa using traditional data methods, such as Pooled Ordinary Least Squares (OLS) regression, Fixed Effects Model (FEM) regression, and Random Effects Model (REM) regression and using the dynamic Generalized Methods of Moments (GMM) on panel data from 2001 to 2023.

Hsiao (2003) and Klevmarken (1989) point to several advantages of panel data, including [28]:

1) Controlling individual variance, as panel data suggests that individuals, firms, states, and countries are heterogeneous.
2) Panel Data provides more informative data, greater variance, higher efficiency, more degrees of freedom, and less collinearity between variables.
3) Panel data is better able to study the dynamics of adjustment, as the relatively stable cross-sectional distributions mask many changes. Unemployment periods, income changes, job turnover, residential and income mobility can be better studied with panel data.

The generalized method of moments provides a method of formulating models and implied estimators without strong distributional assumptions [29]. 'Difference GMM' is so-called because estimation proceeds after first-differencing the data in

order to eliminate the fixed effects [30].

Arellano & Bond (1991) and Blundell & Bond (1998) developed the dynamic generalized moments method for dynamic panel data where the cause and effect relationship of the underlying phenomena is dynamic over time in dynamic panel data, and dynamic panel data estimation techniques for dependent variables use lags [31].

4.1. Results of Pooled Ordinary Least Squares, Fixed Effects and Random Effects

Table 5 shows the regression results for Pooled Ordinary Least Squares, Fixed Effects and Random Effects, where the dependent variable (unemployment) is a function of GDP, inflation, foreign direct investment, and wage and salaried workers. In Table 5, the standard error is shown in parentheses. Column (1) shows results of Pooled Ordinary Least Squares regression model. These results indicate that GDP has a negative effect on unemployment, 1% increase in GDP leads to (0.483%) decrease in unemployment rate. While inflation rate has a positive effect on unemployment, 1% increases in inflation rate leads to (0.245%) increase in unemployment rate. Wage and salaried workers positively affect unemployment, 1% increase in wage workers leads to (0.911%) increase in unemployment rate.

Column (2) shows results of Fixed Effects regression model. It is clear from these results that the percentage of wage workers has a negative effect on unemployment, 1% increase in the percentage of wage and salaried workers leads to (0.213%) decrease in unemployment rate.

Column (3) shows results of Random Effects regression model. These results indicate that the percentage of wage workers has a positive effect on unemployment, 1% increase in the percentage of wage and salaried workers leads to (0.329%) increase in unemployment rate.

Table 5. *The impact of the study variables on the unemployment rate by Using Pooled OLS, FEM and REM Dependent Variable: LNUE.*

	(1)	(2)	(3)
LNGDP	-0.484 (0.120)	-0.087 (0.055)	-0.071 (0.055)
LNINF	0.245 (0.066)	0.030 (0.036)	0.034 (0.036)
LNFDI	0.012 (0.095)	-0.055 (0.047)	-0.020 (0.047)
LNWAGE	0.912 (0.029)	-0.213 (0.098)	0.329 (0.071)
R-Squared	0.574	0.921	0.029
Adjusted R-Squared	0.572	0.917	0.024
Durbin-Watson Stat	0.130	0.386	0.342
F-statistic	261.823	234.211	5.839
Prob (F-statistic)	0.0000	0.0000	0.000124
No. of Observation	782	782	782

4.2. Results of Difference GMM Estimator

Table 6 shows results of GMM, where the dependent variable (unemployment) is a function of GDP log (GDP), inflation log (INF), foreign direct investment log (FDI), and wage and salaried workers log (WAGE). Column (1) represents the results of estimating the impact of Gross Domestic Product (GDP) on the unemployment rate (UE). The results indicate that GDP has a statistically significant negative impact on the unemployment rate, as an increase of (1) in GDP leads to a decrease in unemployment by (0.145).

Column (2) represents the results of estimating the impact of Gross Domestic Product (GDP) and the Inflation Rate (INF) on the unemployment rate (UE). The results indicate that GDP has a statistically significant negative impact on the unemployment rate, as an increase of (1) in GDP leads to a decrease in unemployment by (0.138). The Inflation Rate also has a statistically significant negative impact on the unemployment rate, as an increase of (1) in inflation leads to a decrease in unemployment by (0.037).

Column (3) represents the results of estimating the impact of Gross Domestic Product (GDP), the Inflation Rate (INF), and Foreign Direct Investment (FDI) on the unemployment

rate (UE). The results indicate that GDP has a statistically significant negative impact on the unemployment rate, as an increase of (1) in GDP leads to a decrease in unemployment by (0.116). The inflation rate has a statistically significant negative impact on the unemployment rate, as an increase of (1) in inflation leads to a decrease in unemployment by (0.038). Foreign direct investment (FDI) also has a statistically significant negative impact on the unemployment rate, as an increase of (1) in FDI leads to a decrease in unemployment by (0.087).

Column (4) represents the results of estimating the impact of Gross Domestic Product (GDP), Inflation Rate (INF), Foreign Direct Investment (FDI), and Total wage and salaried workers (WAGE) on the unemployment rate (UE). The results indicate that GDP has a statistically significant negative impact on the unemployment rate, as an increase of (1) in GDP leads to a decrease in unemployment by (0.121). The inflation rate (INF) also has a statistically significant negative impact on the unemployment rate, as an increase of (1) in inflation leads to a decrease in unemployment by (0.036). Foreign direct investment (FDI) has a statistically significant negative impact on the unemployment rate, as an increase in FDI by (1) leads to a decrease in unemployment by (0.094). Finally, total wage and salaried workers (WAGE) also has a negative impact on the unemployment rate, as an increase in the total wage and salary workers index by (1) leads to a decrease in unemployment by (0.097).

Table 6. *The impact of the study variables on the unemployment rate by Using Difference GMM Estimator Dependent Variable: LNUE.*

	(1)	(2)	(3)	(4)
LNUE (-1)	0.677 (0.001)	0.681 (4.74E-05)	0.685 (0.002)	0.679 (0.004)
LNGDP	-0.145 (0.003)	-0.139 (0.001)	-0.116 (0.005)	-0.121 (0.006)
LNINF		-0.038 (0.001)	-0.038 (0.003)	-0.037 (0.003)
LNFDI			-0.088 (0.004)	-0.094 (0.009)
LNWAGE				-0.097 (0.028)
Hansen J-Statistic	37.137	34.234	33.873	32.519
Prob (J- Statistic)	0.284	0.408	0.331	0.344
AR (1)	0.994	0.414	NA	0.999
AR (2)	0.971	0.195	NA	0.994
Instrument Rank	35	36	35	35
No. of Observation	714	714	714	714

The coefficients were estimated using the dynamic GMM estimator. In column (4), the logarithm of unemployment (UE) was used as the dependent variable, and the logarithms of GDP, INF, FDI, and WAGE were used as independent variables. The Hansen J statistic and its corresponding p-value confirm the validity of the automated variables. AR (2) shows the p-value of the Arellano-Bond test, indicating a second-order correlation. The values in parentheses show the Stu. Error. ***, **, and * indicate the significance levels of 1%, 5%, and 10%, respectively. The results of the GMM model indicate that all study variables, namely GDP, inflation, foreign direct investment, and wage and salaried workers, have a negative (significant) impact on unemployment in the African countries studied. The results also indicate that GDP has the greatest impact (B= 0.121) followed by wage and salaried workers (B= 0.097) then foreign direct investment (B= 0.094) then inflation (B= 0.037).

5. Conclusions

Unemployment remains one of the most important economic problems that concern policymakers in all countries of the world, especially developing countries. Therefore, the study aimed to study the factors that affect the unemployment rate in 34 African countries during the period (2001-2023) using the pooled ordinary least squares method, the fixed effects method, the random effects method and the dynamic generalized moments method (GMM).

The results of the study, according to the Generalized Dynamic Moments (GMM) method, indicate an inverse relationship between unemployment and each of the gross domestic product (GDP), inflation (INF), foreign direct investment (FDI), and total wage and salaried workers (WAGE) in the countries under study during the period (2001-2023), where GDP is the most influential determinant, followed by total wage and salaried workers, foreign direct investment, and inflation.

The results of this study can be summarized according to the method of dynamic generalized moments (GMM) as follows:

1) The GDP negatively (significantly) affects the unemployment rate, as a 1% increase in the GDP leads to a decrease in unemployment by 0.121% at a 5% level of significance.
2) Inflation negatively (significantly) affects the unemployment rate, as a 1% increase in inflation leads to a decrease in unemployment by 0.036% at a 5% level of significance.
3) Foreign direct investment negatively (significantly) affects the unemployment rate, as a 1% increase in FDI leads to a decrease in unemployment by 0.094% at a 5% level of significance.
4) Wage and salaried Workers negatively (significantly) affect the unemployment rate, as a 1% increase in the number of salaried Workers leads to a decrease in unemployment by 0.097% at the 5% level of significance.

The study recommends that policymakers and economists work to raise GDP growth rates, create job opportunities for the unemployed, pursue the trade-off between unemployment and inflation and attract foreign direct investment.

Abbreviations

ADF	Augmented Dickey-Fuller
BRIC	Brazil, Russia, India, and China
ECOWAS	Economic Community of West African States
FEM	Fixed Effects Model
G7	Group of Seven (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States)
GMM	Generalized Dynamic Moments
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
REM	Random Effects Model

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Conflicts of Interest

The authors declare no conflicts of interest.

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