

The impact of foreign direct investment inflows on unemployment and economic growth in West Africa

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ABSTRACT

Purpose: This study explores the short- and long-run effects of foreign direct investment inflows (FDI) on both the unemployment rate and economic growth in West Africa utilizing a panel dataset spanning from 1991 to 2022. The precise impact of FDI on these variables and the underlying factors shaping this relationship in West Africa has not been definitively delineated. Previous literature has not exclusively delved into the impact of FDI on the unemployment rate in this region. Consequently, our paper endeavors to address this particular gap in knowledge concentrating on the individual countries within West Africa.

Design/Methodology/Approach: We employ Pooled Mean Group (PMG) estimators and fixed effects models for our analyses.

Findings: Our findings based on the PMG models unveil that FDI exhibits an insignificant positive long-term effect and a highly significant negative short-term impact on economic growth in West Africa. Similarly, we observe that the impact of FDI on the unemployment rate is negative both in the long- and short-term.

Conclusion: Our findings demonstrate that various factors contribute to how FDI influences the unemployment rate and economic growth rate in West Africa.

Research Limitation: The results of these models analyses are subject to the considered economic variables. Other economic variables could give different results.

Practical Implication: The research findings imply that FDI cannot be relied upon as a comprehensive strategy to either stimulate economic growth or alleviate unemployment in the Western Africa region.

Keywords: *Economic growth, FDI, Fixed effects, Pooled mean group, Unemployment, West Africa.*

1. INTRODUCTION

Foreign direct investment (FDI) plays a crucial role in shaping the economic landscape of developing regions. It is often seen as a catalyst for economic growth, providing essential capital, enhancing productivity and creating employment opportunities. However, the relationship between FDI inflows, economic growth and unemployment is complex and can vary significantly across different regions. In West Africa, a region characterized by diverse economies and developmental challenges, understanding the impact of FDI inflows is particularly important. Countries in West Africa have different economic structures, political environments and levels of infrastructure development, all of which can influence the effectiveness of FDI.

Unemployment is a critical issue in West Africa with high rates contributing to poverty, social instability, and underutilization of the labor force. This research can help identify which sectors or types of FDI are most effective at creating jobs by examining how FDI affects unemployment. This knowledge can guide efforts to attract investments that are more likely to reduce unemployment and improve living standards. In a globalized economy, understanding the impact of FDI on developing regions is essential for international investors, multinational corporations and global economic institutions. This research can identify the key determinants of FDI inflows such as trade openness, labor force influence, human development influence, inflationary influence, domestic credit to private sector influence, political stability, infrastructural development, total natural resource influence and regulatory frameworks, providing actionable insights for improving the investment climate. There is a growing

body of literature on the impact of FDI on economic development but specific studies focusing on West Africa are relatively limited, particularly for unemployment. This research can contribute to the academic understanding of FDI in this region, filling gaps in the existing literature and offering new perspectives on how FDI influences economic outcomes in different contexts.

On the other hand, economic growth is viewed as a key indicator of a nation's development and prosperity. In developing regions like West Africa, achieving sustainable economic growth is a primary goal. However, there are differences in the literature that currently exist on the role that FDI plays in generating growth. It is unclear if FDI has a beneficial or detrimental effect in the short- and long-term. It may drive growth and reduce unemployment depending on the type of investment (Wu, Yuan, Wang, Cao, & Zhou, 2020). Various factors influence the complex relationship between FDI, unemployment and growth (Aktar, Demirci, & Öztürk, 2009) differing by region and nation (Clegg, Wang, & Cross, 2004). FDI impacts economic growth and unemployment through several channels. First, FDI inflows aid capital formation which is crucial for growth (Emako, Nuru, & Menza, 2023). Second, FDI can enhance productivity and alter comparative advantages potentially creating jobs and reducing unemployment etc. (Rozen-Bakher, 2017). According to Solow's growth model, the positive impact of FDI on output growth is short-term, with diminishing returns over time (Solow, 1956). This conclusion creates room to delve into FDI's impact on growth and unemployment in West African countries given regional differences.

Our research questions are as follows:

- Is there a significant short- and long-term relationship between FDI and economic growth (EG) in West Africa?
- Is there a significant short- and long-term relationship between FDI and unemployment in West Africa?

Exploring these questions will be answered by conducting empirical model analyses using PMG which will help us understand the complex relationship between FDI and its effects on growth and unemployment in West Africa, focusing on regional similarities and differences. This research can help us uncover the following: 1) Regional disparities and the specific conditions under which FDI can be most beneficial, thus contributing to more balanced regional development strategies. 2) Insights into how global investment trends shape West Africa's economic landscape guiding investment decisions. 3) Identify whether FDI is effectively fostering economic growth and reducing unemployment or if the benefits are unevenly distributed potentially informing more targeted and effective economic policies.

The remaining portion of the paper is organized as follows: Section 2 conducts a literature review on the relationship between foreign direct investment, unemployment and economic growth. Section 3 examines the data (including variables and their sources) and outlines the methods used in empirical research. Section 4 presents the findings of our analysis along with a discussion of the results and we conclude in the final section.

2. LITERATURE REVIEW

2.1. Foreign Direct Investment Inflows and Economic Growth

Foreign direct investment (FDI) is a crucial aspect of global economic integration representing a significant investment made by individuals, companies or entities from one country into business activities located in another. This form of investment involves a substantial level of control and influence by the investor in the foreign enterprise (Hill & McKaig, 2015). The determinants influencing FDI inflows are multifaceted. Factors such as market size and potential, infrastructure quality, availability of resources and skilled labor, political stability, economic conditions, regulatory environment, technological advancement and competitive labor costs all play vital roles in attracting FDI (Loungani & Razin, 2001; Nunthirapakorn, 2020). FDI's impact on economic growth and development is far-reaching. It often brings about increased capital investment leading to infrastructural development and technological advancements. Additionally, it facilitates job creation and skills transfer enhancing the capabilities of the local workforce (Anyanwu & Yameogo, 2015). FDI also promotes innovation as foreign investors often introduce advanced technologies and managerial practices. Furthermore, it can improve trade relations (Aromasodun, 2022) providing better access to global markets and fostering economic diversification (Anyanwu & Yameogo, 2015). However, the impact of FDI is not uniform across all sectors or countries (Blonigen & Wang, 2004; De Mello Jr, 1999). It can vary based on the quality of institutions, the nature of the investment and the level of integration with the local economy (Daude & Stein, 2007; Sabir, Rafique, & Abbas, 2019). Concerns regarding the potential exploitation of resources, unequal distribution of benefits, environmental impacts and socio-economic consequences are also associated with certain FDI projects. The realization of its full potential largely depends on

how effectively host countries manage and regulate these investments to ensure equitable distribution of benefits and sustainable development while FDI can contribute to economic growth. FDI is particularly important to capital scarce countries which may include, developing countries in Africa or countries that underwent systemic transition in the European region (Aromasodun, 2022; Noorbakhsh, Paloni, & Youssef, 2001).

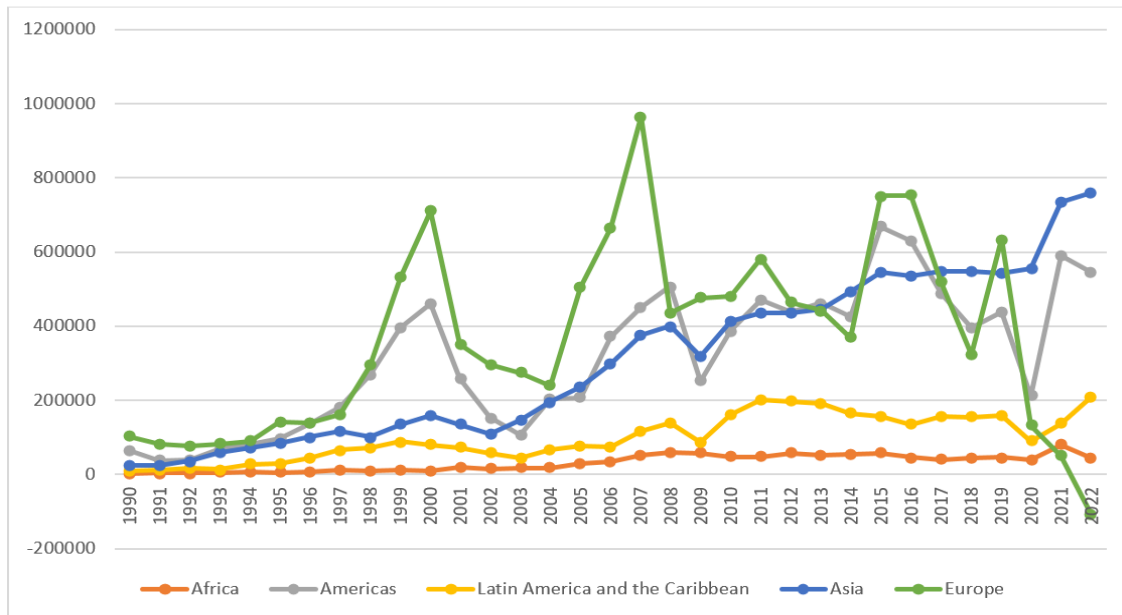


Figure 1. Foreign direct investment inflows to different continents in million US dollars.

There has been an inconsistent upward and downward trend in FDI flows to the continent over the past decade despite the relatively low overall FDI inflows to Africa compared to other continents as illustrated in Figure 1. In 2020, FDI inflows to Africa totalled \$39,195 million, experiencing an 18% decrease from the previous year due to the impact of the COVID-19 pandemic, yet remaining substantial (UNCTAD, 2023, December). Subsequently, in 2021, FDI flows increased to \$79,583 million but declined to \$44,929 million in 2022 accounting for 3.5% of global FDI (UNCTAD, 2023).

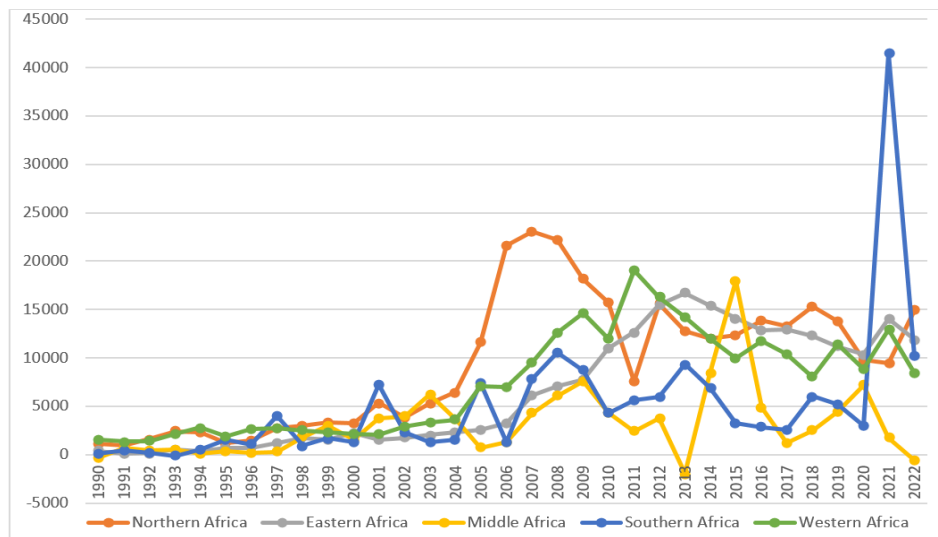


Figure 2. Foreign direct investment inflows to Africa by sub-region millions of dollars.

However, there are differences in how FDI affects economic growth in West Africa. Country-specific factors such as political unrest, poor governance, deficient infrastructure and a lack of physical capital can all have an impact on how FDI affects economic growth. The FDI inflows to Western Africa in recent years seem to have declined, likewise in Middle Africa, Southern Africa and Eastern Africa. However, the case is different for Northern Africa which has experienced a rise in the recent year from 2020-2022 as shown in Figure 2. The essence of Figure 2 is to show the inflows of FDI experienced by Western Africa as compared to other regions in Africa.

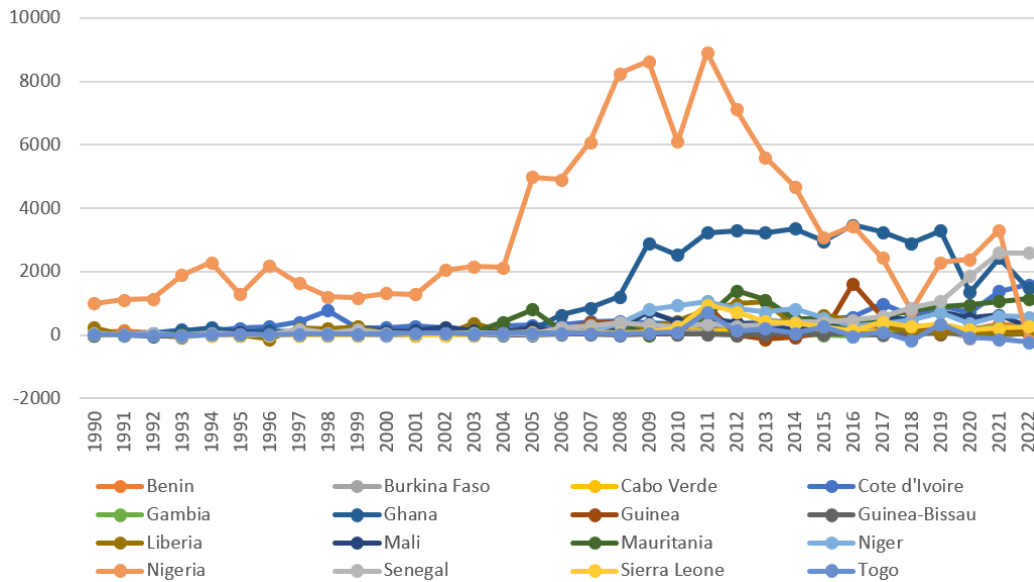


Figure 3. FDI inflows to different countries in Western Africa in million US dollars.

Nigeria and Ghana have experienced a significant portion of FDI inflows in Western Africa; this could be attributed to the level of infrastructural developments, trade policy and openness, quality of institutions, availability of skills labors among other factors in these two countries compared to the rest of the countries in the Western African region. The significance or the level of the FDI inflows could have an impact on economic variables such as unemployment and economic growth.

Table 1. Related empirical studies on the relationship between FDI and economic growth.

| Author(s) | Countries | Years | Methods | Impact |
|---|----------------------------------|-------------|------------------------|-----------------------|
| Baiashvili and Gattini (2020) | 111 countries | 1980-2014 | GMM | Positive and negative |
| Yimer (2023b) | 54 African countries | 2000-2017 | System GMM | Positive and negative |
| Asafo-Agyei and Kodongo (2022) | 49 Sub-Saharan African countries | 1993-2015 | Fixed effects | Positive |
| Shittu, Yusuf, El Moctar El Houssein, and Hassan (2020) | 16 WA countries | 1996 - 2016 | ARDL | Positive and negative |
| Gui-Diby (2014) | 50 African countries | 1980-2009 | System-GMM | Positive |
| Velonjara and Gondje-Dacka (2019) | 9 West African countries | 2000-2016 | Panel-data ARDL | Negative |
| Yimer (2023a) | African countries | 1990-2016 | Econometric panel ARDL | Positive |
| Ramzan, Sheng, Fatima, and Jiao (2019) | 70 developing countries | 1980-2015 | GMM | Positive and negative |

Note: 1. GMM stands for generalized method of moments.
 2. ARDL stands for auto-regressive distributed lag.
 3. WA stands for West Africa.

The low FDI inflows attracted by most of these countries in Western Africa as compared to other continents or regions of the world could be seen as one of the reasons for the negative or low impact of FDI as we found in our analyses results (see [Table 10](#) in the appendix section). Our study seeks to analyze the influence of FDI on both economic growth and unemployment in Western Africa and for the individual countries in Western Africa given the substantial variations in FDI flows across different regions in Africa and countries in Western Africa illustrated in [Figures 2](#) and [3](#) respectively. Specifically, we aim to investigate the short- and long-term effects of FDI within each country comprising this region. The recent studies that investigated the impact of FDI on economic growth apply different research methods and focus on different countries while most studies demonstrate a positive impact of FDI on economic growth, a few other studies show a negative and ambiguous impact as shown in [Table 1](#).

Other notable studies in regard to the impact of FDI on economic growth in Africa are the works of [Adewumi \(2007\)](#), [Awolusi, Adeyeye, and Pelser \(2017\)](#) and [De Mello Jr \(1999\)](#). [Adewumi \(2007\)](#) exerted a significant and positive impact of FDI on economic growth in Africa as a continent. [Awolusi et al. \(2017\)](#) and [De Mello Jr \(1999\)](#) show minimal and non-linear or negative impact on economic growth.

2.2. Foreign Direct Investment Inflows and Unemployment

FDI has a complex relationship with unemployment in West Africa characterized by various influencing factors and nuances ([Folawewo & Adeboje, 2017](#)). FDI which involves investments from foreign entities into the economies of countries in the region has the potential to impact unemployment rates both positively and negatively. When foreign companies invest in West African countries, they bring in capital, technology, expertise, and access to international markets ([Nunthirapakorn, 2020](#)). These investments can spur the development of industries and sectors creating job opportunities for the local population. For instance, FDI in sectors such as telecommunications, manufacturing and services has contributed to job creation in countries like Nigeria and Ghana ([Bazán-Navarro & Álvarez-Quiroz, 2022](#)). However, the impact of FDI on unemployment is not uniform across all sectors and circumstances. One crucial factor is the type and nature of FDI. Investments in industries that are labor-intensive have a higher likelihood of generating employment. Conversely, investments in capital-intensive sectors such as extractive industries like oil and mining might not lead to substantial job creation due to their reliance on technology and machinery, thereby limiting their impact on reducing unemployment rates. Moreover, the skill set of the local workforce plays a significant role. In instances where FDI demands specialized skills that are scarce among the local population, there may be limited employment opportunities despite the investment. This mismatch between the skills required by foreign investors and those possessed by the local workforce can contribute to persistent unemployment issues ([Cuadros, Martín-Montaner, & Paniagua, 2019](#)). Furthermore, the stability and attractiveness of the investment environment are crucial. Political instability, corruption, inconsistent policies and inadequate infrastructure can deter foreign investors, reducing FDI inflows. An uncertain investment climate hampers the potential for job creation and economic development, further impacting unemployment rates in the region ([Hisarciklilar, Gültekin-Karakaş, & Asici, 2014](#)). Another aspect to consider is the reinvestment of profits by foreign companies. If a considerable portion of profits generated from FDI is repatriated back to the investors' home countries instead of being reinvested locally, it can limit the opportunities for job creation and economic growth within West Africa ([Bayar & Sasmaz, 2017](#); [Johnny, Timipere, Krokeme, & Markjackson, 2018](#)). Additionally, the global economic context influences FDI and consequently impacts unemployment in West Africa. Economic downturns or global crises might lead to reduced FDI inflows, which can result in a slowdown in job creation or even job losses in certain sectors, worsening the unemployment situation in the region ([Saleh, 2023](#)). While FDI has the potential to generate employment and alleviate unemployment in West Africa through capital infusion and sectoral development, its impact is contingent on various factors ([Tarzi, 2005](#); [Tsaurai, 2018](#)). Policymakers need to focus on addressing issues related to skill development, investment climate improvement, sectoral diversification and the retention of investment-generated profits within the region to maximize the positive impact of FDI on reducing unemployment.

Studies on the impact of FDI inflows on unemployment in West Africa are non-existent and scanty or very little studies for Africa. However, the few related empirical studies that have been conducted on the relationship between FDI and unemployment are shown in [Table 2](#).

Table 2. Related empirical studies on the relationship between FDI inflows and unemployment in African regions.

| Author(s) | Countries | Years | Methods | Impact |
|--|-------------------------------|-----------|-------------------------|-----------------------|
| Anthony (2018) | Sub-Saharan African countries | 1991-2016 | Pooled OLS, FEM and REM | Positive and negative |
| sWoldetensaye, Sirah, & Shiferaw, (2022) | East African countries | 1996-2021 | Panel data approach | Negative |
| (Alalawneh & Nessa, 2020) | North African countries | 1990-2018 | FEM, REM, panel VAR | Positive |
| (Johnny et al. 2018) | Nigeria | 1980-2015 | Panel data ARDL | Negative |
| Ositaufere and Okafor (2024) | Sub-Saharan African countries | 2000-2021 | PMG/ARDL | Positive |
| (Mkombe et al. 2021) | South Africa | 1994–2017 | FGLS-Parks technique | Negative |
| Behanzin and Konte (2024) | WAEMU member countries | 2000-2018 | VAR | Positive |

Note: 1. OLS: Ordinary Least Square.
2. FEM: Fixed Effects Model.
3. REM: Random Effects Model.
4. VAR: Vector Autoregression.
5. FGLS: Feasible Generalized Least Squares.
6. WAEMU: West African Economic and Monetary Union.

There are no existing studies that have exclusively delved into the studies on the relationship between FDI inflows and unemployment in West African countries. [Table 2](#) shows the ambiguous influence of foreign direct investment (FDI) on unemployment in African countries which makes this study pertinent, noteworthy and a subject open to future research.

2.3. Foreign Direct Investment Inflows, Economic Growth and Unemployment

The relationship between Foreign Direct Investment (FDI) and economic growth has been studied by various researchers over the years and it's challenging to pinpoint a single "first" author that started work on this topic. However, one of the early and influential works in this area is attributed to [Cohen \(2007\)](#) who explored the impact of multinational corporations (MNCs) and their investments on host country economies. Cohen S.D., an economist, published a book titled "Multinational Corporations and Foreign Direct Investment: Avoiding Simplicity, Embracing Complexity" in 2007. This work might not be the absolute first to investigate the impact of FDI on economic growth; it is considered a seminal contribution to the literature on multinational corporations and foreign direct investment. His book delves into the complexities of FDI and its consequences for host countries' economic development making it an important early contribution to the field. Similarly, identifying the absolute first author who investigated the relationship between foreign direct investment inflows and unemployment rate is challenging due to the diverse nature of economic literature. However, some early contributions in the 1980s and 1990s laid the groundwork for understanding the impact of FDI on the unemployment rate. A notable work is by [Blomström & Persson \(1983\)](#). They published a paper titled "Foreign investment and spillover efficiency in an underdeveloped economy: evidence from the Mexican manufacturing industry." While their focus was not exclusively on the unemployment rate, their analysis touched upon the labor market effects of foreign investment, providing an early exploration of the topic. Since then, the investigation into the impact of FDI on unemployment has evolved over time, with subsequent researchers contributing more nuanced perspectives and empirical studies on this relationship. Scholars in different countries and regions have conducted specific studies to assess how FDI influences unemployment dynamics making it a continually evolving area of research. The literature on the studies of the relationship between FDI inflows, unemployment and economic growth is relatively scant or non-existent. However, few related studies in the African regions are the works of [Folawewo and Adeboje \(2017\)](#), [Kukaj, Nimani, and Usaj \(2022\)](#) and [Bisiriyu and Osinusi \(2020\)](#). [Folawewo and Adeboje \(2017\)](#) conducted an analysis on the relationship between macroeconomic indicators and the unemployment rate within the Economic Community of West African States (ECOWAS) using a combination of fixed and random effects models as well as fully modified ordinary least squares (FMOL) panel data estimation techniques. This study revealed that foreign direct investment (FDI) has a weak negative impact on the unemployment rate while economic growth shows a negligible though

reducing effect on unemployment from 1991 to 2014. [Kukaj et al. \(2022\)](#) explored the interplay between FDI, economic growth and unemployment across selected developing countries from 2015 and 2019. Their findings indicated that both FDI and economic growth contribute to reducing unemployment. However, the effect of FDI on economic growth remains uncertain in the developing nations studied. [Bisiriyu and Osinusi \(2020\)](#) examined the influence of FDI and economic growth on the unemployment rate in Nigeria, analyzing time series data from 1981 to 2017 with the OLS method and found that both FDI and economic growth are significant in reducing the unemployment rate in Nigeria. Overall, the existing literature has shown contrary views on the impact of FDI on economic growth and unemployment. Some studies indicate a positive or negative relationship between foreign direct investment (FDI), economic growth, and unemployment. However, other studies suggest that the influence of FDI is dependent upon a country's financial market development, policy, human capital, infrastructure, political stability, and institutional quality ([Acemoglu, Johnson, & Robinson, 2005](#); [Bissoon, 2012](#)).

3. DATA AND METHODOLOGIES

In this study, we analyze a sample for 16 countries from Western Africa (see [Figure 3](#) and [Table 10](#) for the list of the countries). Our analysis employs annual data from 1991-2022. The selection of these specific Western African countries was motivated by the scarcity of research concerning the influence of Foreign Direct Investment (FDI) on unemployment and economic growth within the region. The chosen timeframe of 31 years was determined based on data availability considerations. In the empirical analysis, we adopted two methods: the panel fixed effects which allow estimating coefficients of the fixed effects panel models and the pooled mean group estimator (PMG). The selection of the first method adheres to standard practice particularly for smaller panels. In contrast, the second method aligns with our interest in allowing the short-term dynamics to differ across groups while constraining the long-term relationships between FDI inflows, economic growth and the unemployment rate. This method combines elements of both pooling (assuming common long-term relationships) and averaging (allowing for heterogeneity in short-term dynamics) within each sample. This basically justifies the use of the PMG models. In addition, we have carried out the dependency of the cross-section test using the Friedman CD test that was proposed by [Friedman \(1937\)](#). Unit roots were examined with Im-Pesaran-Shin's test proposed by [Im, Pesaran, and Shin \(2003\)](#) because it is the test suitable for unbalanced panel data. Cointegration among the regressors and the regress was examined with the Pedroni Cointegration Test proposed by [Pedroni \(2004\)](#). It is noteworthy to state that this study is limited in methodologies as there are alternative methods such as the generalized method of moments (GMM) and dynamically common correlated effects (DCCE) that can also be utilized for the analyses.

3.1. Variable Descriptions

We choose 10 economic variables for our analyses. They are categorized as dependent, independent and control variables as shown in [Table 3](#). The control variables are chosen considering their impacts on economic growth and unemployment rate based on the findings of the existing literature.

Table 3. Variable descriptions.

| Dependent variables | Abbreviation | Source of data |
|---|--------------|------------------------------------|
| Economic growth (Rate of change of real GDP). | EG | World bank |
| Unemployment rate (Annual % of labor force) | UNEM | National authorities, OECD and IMF |
| Independent variables | Abbreviation | Source of data |
| Foreign direct investment inflows | FDI | UNCTAD |
| Control variables | Abbreviation | Source of data |
| Inflation rate (Annual and% of GDP) | Inflation | World bank |
| Total natural resources rents (Annual % of GDP) | TNR | World bank |
| Gross capital formation (Annual % of GDP) | GCF | World bank |
| Trade openness (Annual % of GDP) | TO | World bank |
| Domestic credit to the private sector (Annual % of GDP) | DC_PS | World bank |
| Labor force (In million people) | LAB_F | World bank |
| Human development index | HDI | World bank |

Note: 1. GDP stands for gross domestic product.
2. IMF stands for international monetary fund.
3. UNCTAD stands for United Nations conference on trade and development.

3.2. Descriptive Statistics

This will provide us with brief informational coefficients that help to summarize our data set as shown in Table 4.

Table 4. Descriptive statistics for West Africa

| Variables | Obs. | Mean | Std. dev. | Min. | Max. |
|-----------|------|--------|-----------|--------|--------|
| FDI | 510 | 3.706 | 7.773 | -53.53 | 70.35 |
| GCF | 488 | 19.261 | 10.214 | -2.42 | 66.47 |
| Inflation | 463 | 7.364 | 10.700 | -7.8 | 72.8 |
| LAB_F | 512 | 6.608 | 11.939 | 0.12 | 73.27 |
| UNEM | 512 | 4.742 | 3.098 | 0.32 | 14.88 |
| TO | 493 | 58.919 | 19.615 | 16.35 | 154 |
| EG | 502 | 3.996 | 4.815 | -30.15 | 26.52 |
| DC_PS | 452 | 14.422 | 11.624 | 0 | 73.19 |
| HDI | 443 | 0.431 | 0.089 | 0.217 | 0.665 |
| TNR | 486 | 10.772 | 7.854 | 1.717 | 56.333 |

3.3. Theoretical Framework and Model Specification

3.3.1. Fixed Effect Regression Models and Descriptions

We performed both fixed and random regression models and conducted a Hausman test to decide which is the best and suitable for our analyses. We found that the fixed effect model is most suitable as the p-value is less than 0.05 which confirms the null hypothesis of the Hausman test for the fixed effect model based on the test result. The fixed effect model can be written as

$$y_{it} = \beta_{0it} + \beta_1 x_{1,it} + \beta_2 x_{2,it} + \dots + \beta_k x_{k,it} + e_{it}, \quad (1)$$

Where y_{it} denotes our variables of interest of individual i (economic growth and unemployment) for the time period t , each $x_{j,it}$ is the value of the independent variable j for individual i (INFLATION, TNR, GCF, TO, UNEM, LAB_F, FDI and DC_PS) for the time period and $k = 8$ is the number of explanatory variables.

3.3.2. Pooled Mean Group Model Specification

The PMG approach accommodates differences in intercepts, short-run variable coefficients and error terms across country groups while ensuring that the coefficients of the long-run regressors remain consistent across these groups. Using a panel dataset with time periods $t = 1, 2, 3, \dots, T$ and groups of countries $i = 1, 2, 3, \dots, N$, the following panel ARDL ($p, q, q, \dots, q, 1$) model is estimated as follows:

$$EG_{it} = \sum_{j=1}^p \gamma_{ij} EG_{it-j} + \sum_{j=0}^q \delta'_{ij} Y_{it-j} + \mu_i + \varepsilon_{it} \quad (2)$$

The above panel ARDL ($p, q, q, \dots, q, 1$) model, $Y_{it}(k \times 1)$ shows the vectors of the independent variables i, μ_i are the fixed effect, the coefficients of the lagged dependent variable that EG ; γ_{ij} is the scalars in the equation and δ_{ij} is the $(k \times 1)$ coefficient of the vector. The primary characteristics of both the dependent and independent variables in the model above indicate that the error correction model which delineates the short-term dynamics of the dependent variable and the independent variables in the system is influenced by deviations from equilibrium. The above panel ARDL ($p, q, q, \dots, q, 1$) equation can be re-specified as

$$\Delta EG_{it} = \varphi_i (EG_{it-1} - \vartheta'_i Y_{it-j}) + \sum_{j=1}^{p-1} \gamma^*_{ij} \Delta EG_{it-1} + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta Y_{it-j} + \mu_i + \varepsilon_{it} \quad (3)$$

Where $\varphi_i = -(1 - \sum_{j=1}^p \gamma_{ij})$, $\vartheta_i = \sum_{j=0}^q \frac{\delta_{ij}}{1 - \alpha_k} Y_{ik}$, $\gamma^*_{ij} = -\sum_{m=j+1}^p \gamma_{im}$, $j = 1, 2, 3, \dots, p - 1$ and $\delta'^*_{ij} = -\sum_{m=j+1}^{q-1} \delta_{im}$, $j = 1, 2, 3, \dots, q - 1$. φ_i is the speed of adjustment to its equilibrium which is the error correction speed. If the error correction speed of adjustment examined is equal to zero, if $\varphi_i = 0$, it means that no long-run relationship exists between the regressand and the regressors. It is expected that the error correction term to be negative and significant to show the model would converge to equilibrium in the long-run. The term ϑ'_i indicates the long-run relationship between the regressand and the regressors. Equation 3 is rewritten as below to include the economic growth model:

$$EG_{it} = \beta_0 + \varphi_{1,i} [EG_{it-1} - \vartheta'_{2,i} (GCF_{it}, INFLATION_{it}, Lab_{F_{it}}, UNEM_{it}, TO_{it}, FDI_{IN_{it}}, DC_{PS_{it}}, HDI_{it}, TNR_{it})] + \sum_{j=1}^{p-1} \gamma^*_{ij} \Delta EG_{it-1} + \sum_{j=0}^{q-1} \delta'^*_{ij} \Delta GCF_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{1ij} \Delta INFLATION_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{2ij} \Delta Lab_{F_{it-j}} +$$

$$\sum_{j=0}^{q-1} \delta'^*_{3ij} \Delta UNEM_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{4ij} \Delta TO_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{5ij} \Delta FDI_{INit-j} + \sum_{j=0}^{q-1} \delta'^*_{6ij} \Delta DC_{PSit-j} + \sum_{j=0}^{q-1} \delta'^*_{7ij} \Delta HDI_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{8ij} \Delta TNR_{it-j} + \mu_i + \varepsilon_{it} \quad (4)$$

Similarly, the equation is written as below for the unemployment model:

$$\Delta UNEM_{it} = \beta_0 + \varphi_{1,i} \left[UNEM_{it-1} - \vartheta'_{2,i} (GCF_{it}, INFLATION_{it}, Lab_{F_{it}}, TO_{it}, FDI_{INit}, DC_{PS_{it}}, HDI_{it}, TNR_{it})' \right] + \sum_{j=1}^{p-1} \gamma^*_{ij} \Delta UNEM_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{1ij} \Delta GCF_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{2ij} \Delta INFLATION_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{3ij} \Delta Lab_{F_{it-j}} + \sum_{j=0}^{q-1} \delta'^*_{4ij} \Delta TO_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{5ij} \Delta FDI_{INit-j} + \sum_{j=0}^{q-1} \delta'^*_{6ij} \Delta DC_{PS_{it-j}} + \sum_{j=0}^{q-1} \delta'^*_{7ij} \Delta HDI_{it-j} + \sum_{j=0}^{q-1} \delta'^*_{8ij} \Delta TNR_{it-j} + \mu_i + \varepsilon_{it} \quad (5)$$

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Fixed Effect Regression Models Result

Table 5 shows the summary of our analysis estimates for the considered two dependent variables (economic growth and unemployment) for West Africa.

Table 5. Fixed effect coefficient estimates for economic growth and unemployment models.

| Variables | Economic growth (e.g) | | | Unemployment (unem) | | |
|-----------|-----------------------|----------|---------|---------------------|----------|---------|
| | Coef. | Std.err. | P-value | Coef. | Std.err. | P-value |
| FDI | -0.153 | 0.043 | 0.000 | -0.010 | 0.012 | 0.411 |
| GCF | 0.103 | 0.045 | 0.023 | -0.028 | 0.013 | 0.027 |
| HDI | 14.353 | 8.020 | 0.074 | -4.737 | 2.236 | 0.035 |
| Inflation | -0.005 | 0.035 | 0.878 | 0.020 | 0.010 | 0.049 |
| LAB_F | -0.242 | 0.145 | 0.096 | 0.035 | 0.041 | 0.390 |
| TNR | 0.087 | 0.052 | 0.095 | -0.040 | 0.014 | 0.005 |
| TO | 0.084 | 0.021 | 0.000 | 0.028 | 0.010 | 0.000 |
| DC_PS | -0.138 | 0.048 | 0.004 | 0.027 | 0.013 | 0.045 |
| Constant | -1.689 | 2.809 | 0.548 | 5.219 | 0.737 | 0.000 |

Table 5 provides the coefficient estimates, standard errors and p-values for each variable. We observe that a one-unit change in FDI corresponds to a -0.153 percentage point change in economic growth (with GDP growth as a proxy) which is statistically significant given the p-value being less than 0.05 interpreting the impact of FDI on economic growth in the West Africa region. Conversely, a one-unit change in FDI results in a -0.010 percentage point change in unemployment but this effect is not statistically significant. The interpretation of the effects of the remaining independent variables on economic growth and unemployment follows a similar approach.

Table 6. Results for PMG estimator for economic growth (GDP) model.

| Variables | Coef. | Std.err. | z | P-value |
|------------------------|--------|----------|--------|----------|
| Long-run coefficients | | | | |
| FDI | 0.034 | 0.044 | 0.79 | 0.431 |
| Inflation | -0.015 | 0.030 | -0.49 | 0.625 |
| LAB_F | -0.387 | 0.182 | -2.13 | 0.033** |
| UNEM | -0.318 | 0.166 | -1.91 | 0.056** |
| TO | 0.094 | 0.017 | 5.70 | 0.000*** |
| GCF | -0.102 | 0.044 | -2.33 | 0.020** |
| DC_PS | -0.053 | 0.035 | -1.49 | 0.136* |
| HDI | 18.070 | 7.052 | 2.56 | 0.010*** |
| TNR | -0.010 | 0.023 | -0.46 | 0.649 |
| Short-run coefficients | | | | |
| ECT(-1) | -0.861 | 0.057 | -15.13 | 0.000*** |
| FDI | -0.167 | 0.122 | -1.36 | 0.173 |

| Variables | Coef. | Std.err. | z | P-value |
|-----------|---------|----------|-------|----------|
| Inflation | -0.021 | 0.885 | -0.24 | 0.814 |
| LAB_F | 50.310 | 21.140 | 2.38 | 0.017 |
| UNEM | -3.472 | 1.526 | -2.28 | 0.023** |
| TO | -0.026 | 0.072 | -0.36 | 0.719 |
| GCF | 0.379 | 0.183 | 2.07 | 0.038** |
| DC_PS | 0.192 | 0.219 | 0.88 | 0.380 |
| HDI | 147.163 | 65.259 | 2.26 | 0.024** |
| TNR | -0.258 | 0.210 | -1.23 | 0.220 |
| Constant | -5.899 | 1.842 | -3.20 | 0.001*** |

Note: *** p<0.01, ** p<0.05, * p<0.1. These asterisks determine the order of importance of the variables significance levels with *** being more significant followed by ** and then *.

4.2. Pooled Mean Group Panel ARDL Estimates Results

According to Table 6's results, FDI has a statistically insignificantly small but positive long-term influence and a statistically insignificantly small but negative short-term impact on the GDP growth rate which is a measure of economic growth. This implies that over the long run, a one-unit change in FDI would result in a 0.0342 percentage point increase in economic growth while in the short-term, a one-unit change in FDI would lead to a 0.1667 percentage point decrease in the economic growth of these West African countries.

Table 7. Results for PMG estimator for unemployment (UNEM) model.

| Variables | Coef. | Std.err. | Z | P-value |
|------------------------|--------|----------|-------|----------|
| Long-run coefficients | | | | |
| FDI | 0.102 | 0.027 | 3.82 | 0.000*** |
| Inflation | 0.032 | 0.017 | 1.96 | 0.050** |
| LAB_F | 0.979 | 0.399 | 2.46 | 0.014*** |
| TO | -0.001 | 0.004 | -0.32 | 0.746 |
| GCF | -0.153 | 0.048 | -3.19 | 0.001*** |
| DC_PS | 0.007 | 0.019 | 0.35 | 0.727 |
| HDI | 0.057 | 5.882 | 0.01 | 0.992 |
| TNR | -0.153 | 0.034 | -4.46 | 0.000*** |
| Short-run coefficients | | | | |
| ECT(-1) | -0.110 | 0.027 | -4.07 | 0.000*** |
| FDI | 0.017 | 0.014 | 1.26 | 0.208 |
| Inflation | -0.006 | 0.008 | -0.72 | 0.474 |
| LAB_F | -2.469 | 2.068 | -1.19 | 0.233 |
| TO | -0.004 | 0.005 | -0.30 | 0.764 |
| GCF | 0.203 | 0.215 | 0.94 | 0.345 |
| DC_PS | -0.009 | 0.016 | -0.61 | 0.545 |
| HDI | 1.685 | 8.531 | 0.20 | 0.843 |
| TNR | 0.039 | 0.024 | 1.62 | 0.106 |
| Constant | 0.760 | 0.338 | 2.25 | 0.024** |

Note: *** p<0.01, ** p<0.05. These asterisks determine the order of importance of the variables significance levels, with *** being more significant followed by ** and then *.

Similarly, the interpretation of the findings from Table 7 reveals that over the long-term, FDI inflows into West African countries have a statistically significant and positive effect on unemployment while in the short-term; the impact is positive but not statistically significant. This suggests that in the long-term, a one-unit increase in FDI would result in a 0.1021 unit increase in unemployment whereas in the short-term, a one-unit change in FDI

would lead to a 0.0169 unit increase in unemployment for West African countries. This invariably means that FDI inflows affect the unemployment rate negatively in West Africa.

Table 8. FDI coefficients estimate the impact of individual countries on the economic growth (GDP) model.

| Country | Variable | Coef. | Std.err. | P value | ECT |
|------------------------|----------|--------|----------|----------|--------|
| Long-run coef. | FDI | 0.034 | 0.044 | 0.431 | - |
| Short-run coefficients | | | | | |
| Benin R. | FDI | 0.490 | 0.321 | 0.127 | -0.610 |
| Burkina F. | | -0.262 | 0.272 | 0.336 | -0.808 |
| Cabo V. | | -0.058 | 0.158 | 0.712 | -1.240 |
| Gambia | | -1.629 | 0.396 | 0.000*** | -1.286 |
| Ghana | | 0.262 | 0.213 | 0.218 | -0.746 |
| Guinea | | -0.014 | 0.079 | 0.857 | -0.777 |
| Guinea B. | | 0.473 | 0.215 | 0.028** | -0.899 |
| Côte d'Ivoire | | -0.124 | 0.501 | 0.805 | -0.694 |
| Liberia | | -0.265 | 0.037 | 0.000*** | -0.739 |
| Mali | | -0.245 | 0.245 | 0.319 | -1.167 |
| Mauritania | | 0.062 | 0.086 | 0.475 | -0.990 |
| Niger | | 0.088 | 0.435 | 0.839 | -1.094 |
| Nigeria | | -0.459 | 0.928 | 0.621 | -0.572 |
| Senegal | | -0.468 | 0.313 | 0.135 | -0.820 |
| Sierra Leone | | -0.434 | 0.207 | 0.036** | -0.664 |
| Togo | | -0.084 | 0.175 | 0.633 | -0.674 |

Note: *** p<0.01, ** p<0.05. These asterisks determine the order of importance of the variables significance levels with *** being more significant followed by ** and then *. ECT: Error correction term.

Table 8 highlights the estimated coefficients that illustrate the effect of foreign direct investment (FDI) inflows on economic growth. The long-term impact of FDI on economic growth is consistent across West African countries using the pooled mean group method. However, the short-term coefficients show variation among different nations. Specifically, Table 8 reveals that the short-term impact of FDI on economic growth is positive but not statistically significant in Benin Republic, Ghana, Mauritania and Niger Republic. On the other hand, FDI has a negative yet statistically insignificant short-term effect on economic growth in Burkina Faso, Cabo Verde, Guinea, Côte d'Ivoire, Mali, Nigeria, Senegal, and Togo. In contrast, the short-term effect of FDI is negative and significant in Gambia, Liberia, and Sierra Leone, while Guinea-Bissau experiences a positive and significant impact. Overall, FDI has a positive but statistically insignificant effect on economic growth in West Africa over the long-term.

Table 9. FDI coefficients estimate the impact of individual countries on unemployment (UNEM) model.

| Country | Variable | Coef. | Std.err. | P value | ECT |
|------------------------|----------|--------|----------|----------|--------|
| Long-run coef. | FDI | 0.102 | 0.027 | 0.000*** | - |
| Short-run coefficients | | | | | |
| Benin R. | FDI | 0.070 | 0.102 | 0.489 | -0.099 |
| Burkina F. | | 0.009 | 0.036 | 0.809 | -0.129 |
| Cabo V. | | -0.073 | 0.028 | 0.010*** | -0.207 |
| Gambia | | 0.058 | 0.035 | 0.100* | -0.066 |
| Ghana | | 0.025 | 0.114 | 0.827 | -0.117 |
| Guinea | | 0.004 | 0.005 | 0.379 | -0.151 |
| Guinea B. | | -0.017 | 0.008 | 0.036** | 0.029 |
| Côte d'Ivoire | | 0.125 | 0.128 | 0.328 | -0.192 |
| Liberia | | 0.008 | 0.001 | 0.000*** | 0.097 |
| Mali | | -0.023 | 0.014 | 0.089 | -0.228 |

| Country | Variable | Coef. | Std.err. | P value | ECT |
|--------------|----------|--------|----------|---------|--------|
| Mauritania | | -0.005 | 0.004 | 0.296 | -0.015 |
| Niger | | -0.049 | 0.079 | 0.538 | -0.142 |
| Nigeria | | 0.053 | 0.060 | 0.381 | -0.019 |
| Senegal | | 0.106 | 0.127 | 0.407 | -0.175 |
| Sierra Leone | | 0.006 | 0.007 | 0.418 | -0.015 |
| Togo | | -0.026 | 0.013 | 0.052** | -0.326 |

Note: *** p<0.01, ** p<0.05, * p<0.1. These asterisks determine the order of importance of the variables significance levels with *** being more significant followed by ** and then *.ECT: Error correction term.

Similarly, the results presented in Table 9 reveal the dynamics of the unemployment model. In the short-term, the correlation between FDI and unemployment across several countries such as the Benin Republic, Burkina Faso, Gambia, Ghana, Guinea, Cote d'Ivoire, Nigeria, Senegal and Sierra Leone is positive but statistically insignificant. This implies that the effect is not deemed statistically significant while an increase in FDI may lead to higher unemployment rates in these countries. Conversely, for Cabo Verde, Mali, Mauritania and Niger, the short-term impact of FDI on unemployment is negative but not statistically significant suggesting that an increase in FDI may lead to decreases in unemployment in these countries, although the effect lacks statistical significance. In contrast, Guinea Bissau and Togo exhibit a statistically significant and negative relationship between FDI and unemployment in the short-term indicating that an increase in FDI corresponds to a decrease in unemployment rates for these countries. However, for Liberia, the relationship between FDI and unemployment is both positive and significant implying that an increase in FDI would result in a rise in unemployment in this particular country. In the long-term, the overall effect of FDI on unemployment in West Africa is positive and significant signifying that a unit change in FDI to West Africa over the long-term would lead to an increase in unemployment.

5. CONCLUSION AND FINDINGS

The findings of this study from the analyses of the PMG models indicate that FDI inflows (FDI) affect economic growth positively in the long-run but negatively in the short-run in West Africa. Furthermore, FDI exerts a positive and statistically significant long-term influence on unemployment with an insignificant positive impact in the short-term in West Africa indicating that a unit change in FDI inflows to the region would lead to an increase in unemployment. This implies that FDI inflows affect unemployment rate negatively both in the long-run and short-run in the West African region. Comparatively, our findings regarding the long-term impact of FDI on economic growth are in line with the findings of Yimer (2023a) and Gui-Diby (2014). Our findings are in line with the works of Anthony (2018) with regard to the long- and short-run impact of FDI inflows on the unemployment rate. The long-term impact of FDI for each of the models is the same across countries since we have used the pooled mean group (pooling) method (see Tables 8 and 9). We propose that to foster economic growth in West Africa, reliance solely on the attractiveness of FDI inflows as a short-term plan should be avoided. Instead, the region should develop a long-term strategy aimed at sustaining FDI inflows based on our findings. Moreover, the notion of relying on FDI inflows attractiveness as a plan whether in the short- or long-run should be discarded altogether to address unemployment. At the individual country level, our recommendations vary. Gambia, Liberia and Sierra Leone are advised against using FDI inflow attractiveness as a short-term strategy for stimulating economic growth. Conversely, Guinea-Bissau could consider leveraging attractiveness FDI inflow as a means to spur economic growth in the short-term. Regarding unemployment reduction, Guinea-Bissau and Togo are encouraged to regard FDI inflows attractiveness as a short-term strategy to be considered. These tailored recommendations take into account the unique circumstances and potential benefits each country may derive from FDI inflows (see Table 10 in the Appendix section for more results on the impact of FDI for the individual countries in West Africa).

FUNDING

This study received no specific financial support.

INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

TRANSPARENCY

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

COMPETING INTERESTS

The author declares that there are no conflicts of interests regarding the publication of this paper.

ARTICLE HISTORY

Received: 8 July 2024/ Revised: 12 September 2024/ Accepted: 27 September 2024/ Published: 14 October 2024

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APPENDIX

Table 10. Short-term impact of FDI inflows on unemployment (UNEM) and economic growth (EG) for individual countries in West Africa.

| Country | Short term impact direction (UNEM) | Significant/In significant direction (UNEM) | Short term impact direction (EG) | Significant/In significant direction (EG) |
|---------------|------------------------------------|---|----------------------------------|---|
| Benin R. | Positive | Insignificant | Positive | Insignificant |
| Burkina F. | Positive | Insignificant | Negative | Insignificant |
| Cabo V. | Negative | Insignificant | Negative | Insignificant |
| Gambia | Positive | Insignificant | Negative | Significant |
| Ghana | Positive | Insignificant | Positive | Insignificant |
| Guinea | Positive | Insignificant | Negative | Insignificant |
| Guinea B. | Negative | Significant | Positive | Significant |
| Côte d'Ivoire | Positive | Insignificant | Negative | Insignificant |
| Liberia | Positive | Significant | Negative | Significant |
| Mali | Negative | Insignificant | Negative | Insignificant |

| Country | Short term impact direction (UNEM) | Significant/In significant direction (UNEM) | Short term impact direction (EG) | Significant/In significant direction (EG) |
|--------------|------------------------------------|---|----------------------------------|---|
| Mauritania | Negative | Insignificant | Positive | Insignificant |
| Niger | Negative | Insignificant | Positive | Insignificant |
| Nigeria | Positive | Insignificant | Negative | Insignificant |
| Senegal | Positive | Insignificant | Negative | Insignificant |
| Sierra Leone | Positive | Insignificant | Negative | Significant |
| Togo | Negative | Significant | Negative | Insignificant |

The similarities and differences in the impact of FDI inflows on economic growth and unemployment for these countries in Western Africa are attributed to the similarities and differences in the impact of some economic factors or variables (such as inflation rate, total natural resources rent, gross capital formation, trade openness, domestic credit to private sector, labor force, human development and in the overall economic structures) for these countries.

Table 11. Literature on the impact of FDI on economic growth (EG) for individual countries in West Africa.

| Country | Author(s) | Years | Methods | Impact direction (EG) |
|---------------|--|-----------|--------------------------------|-------------------------------|
| Benin R. | Marcel (2019) | 1970-2017 | ECM | Negative |
| Burkina F. | Zandile and Phiri (2019) | 1970-2017 | ARDL | Ambiguous |
| Cabo V. | Duarte, Kedong, and Xuemei (2017) | 1987-2014 | ARDL | Positive |
| Gambia | Gaye and Njie (2023) | 1980-2018 | OLS | Positive |
| Ghana | Issahaku (2019) | 1985-2017 | Regression model | Positive (ST) |
| Guinea | Cisse (2023) | - | ARDL | Positive(ST) and negative(LT) |
| Guinea B. | - | - | - | - |
| Côte d'Ivoire | Iritié and Tiémélé (2023) | 1980-2019 | ARDL | Negative |
| Liberia | Sackor (2017) | 1980-2013 | Regression analysis | Positive |
| Mali | Camara (2024) | 1985-2015 | Regression analysis | Positive |
| Mauritania | Ould (2015) | 1976-1995 | Regression analysis | Positive |
| Niger | Ousseini, Hu, and Aboubacar (2015) | 1980-2012 | VECM | Negative |
| Nigeria | Awe (2013) | 1976-2026 | Two-stage least squares (2SLS) | Negative |
| Senegal | Baye (2020) | 1985-2008 | VECM | Negative (ST) & positive (LT) |
| Sierra Leone | Duramany-Lakkoh, Jalloh, and Jalloh (2021) | 1980-2016 | Regression analysis | Negative |
| Togo | Aboudou (2010) | 1975-2008 | OLS | Ambiguous |

Note: 1. ST – short term.
2. LT – long-term.

Table 12. Literature on the impact of FDI on unemployment (UNEM) for individual countries in West Africa.

| Countries | Author(s) | Years | Methods | Impact direction (UNEM) |
|---------------|--|-----------|---------|-------------------------------|
| Benin R. | - | - | - | - |
| Burkina F. | - | - | - | - |
| Cabo V. | - | - | - | - |
| Gambia | Bojang and Suliswanto (2024) | 1990-2021 | ARDL | Positive |
| Ghana | Addo (2019) | 2000-2016 | ARDL | Positive |
| Guinea | Keita and Baorong (2021) | 1990-2017 | ARDL | Negative |
| Guinea B. | - | - | - | - |
| Côte d'Ivoire | Aderemi, Omitogun, and Osisanwo (2022) | 1990-2019 | ARDL | Positive (LT) & negative (ST) |
| Liberia | - | - | - | - |
| Mali | - | - | - | - |
| Mauritania | - | - | - | - |
| Niger | - | - | - | - |
| Nigeria | Chike and Okeke (2024) | 1990-2020 | DOLS | Ambiguous |
| Senegal | - | - | - | - |
| Sierra Leone | - | - | - | - |
| Togo | - | - | - | - |

Note: 1. ST – short term.
2. LT – long-term.

Table 10 shows how the findings of our research on the impact of FDI on economic growth and unemployment for individual countries in West Africa compare to the findings of the existing literature in Table 11 and Table 12. Countries where they are dashes (“-”) in the Tables are where there are no literature for this research area.

Table 13. Correlation matrix for West African countries.

| Variables | EG | GCF | Inflation | LAB_F | UNEM | TO | FDI | DC_PS | HDI | TNR |
|-----------|---------|---------|-----------|---------|--------|--------|--------|--------|--------|--------|
| EG | 1.0000 | | | | | | | | | |
| GCF | 0.1291 | 1.0000 | | | | | | | | |
| Inflation | 0.0539 | 0.1330 | 1.0000 | | | | | | | |
| LAB_F | 0.0504 | 0.1452 | 0.1928 | 1.0000 | | | | | | |
| UNEM | -0.1230 | -0.1808 | 0.0626 | -0.0828 | 1.0000 | | | | | |
| TO | 0.1095 | 0.1588 | 0.1783 | -0.2912 | 0.4449 | 1.0000 | | | | |
| FDI | -0.0956 | 0.3311 | 0.0355 | -0.1106 | 0.0243 | 0.3962 | 1.0000 | | | |
| DC_PS | -0.0466 | -0.2820 | -0.2658 | -0.0941 | 0.4617 | 0.3791 | 0.0408 | 1.0000 | | |
| HDI | 0.0372 | -0.0269 | 0.0628 | 0.1853 | 0.5030 | 0.5077 | 0.1492 | 0.6145 | 1.0000 | |
| TNR | 0.0915 | 0.0413 | 0.2138 | 0.0234 | 0.1854 | 0.5472 | 0.4230 | 0.2574 | 0.3343 | 1.0000 |

In examining the correlations between variables in West Africa, as illustrated in Table 13, we observe that FDI demonstrates a negative correlation with economic growth (EG) and a positive correlation with unemployment (UNEM). This suggests that an increase in economic growth results in a decrease in FDI and conversely, an increase in FDI leads to a proportional increase in unemployment (UNEM) and vice versa. Upon closer inspection of the data, we find that the variables exhibit low autocorrelation. Consequently, we can confidently assert the absence of serial autocorrelation in our models. Nevertheless, we have conducted multicollinearity tests to further validate the reliability of our findings.

Table 14. Test for multicollinearity for economic growth model.

| Variables | VIF | 1/VIF |
|-----------|------|--------|
| TO | 2.88 | 0.3367 |
| HDI | 2.53 | 0.3954 |
| DC_PS | 2.33 | 0.4288 |
| TNR | 1.77 | 0.5637 |
| LAB_F | 1.64 | 0.6104 |
| UNEM | 1.61 | 0.6221 |
| FDI | 1.48 | 0.6737 |
| GCF | 1.45 | 0.6875 |
| Inflation | 1.37 | 0.7282 |
| Mean VIF | 1.90 | |

Note: VIF stands for variance inflation factor

Table 15. Test for multicollinearity unemployment model.

| Variables | VIF | 1/VIF |
|-----------|------|--------|
| TO | 2.70 | 0.3706 |
| HDI | 2.42 | 0.4129 |
| DC_PS | 2.28 | 0.4390 |
| TNR | 1.75 | 0.5715 |
| LAB_F | 1.64 | 0.6105 |
| FDI | 1.48 | 0.6759 |
| GCF | 1.41 | 0.7083 |
| inflation | 1.36 | 0.7346 |
| Mean VIF | 1.88 | |

Note: VIF stands for variance inflation factor

Looking at the VIF and the tolerance (1/VIF) for the two models in Tables 14 & 15, we can confidently say there is no issue of multicollinearity as no tolerance is below 0.2 and none of the VIFs for each of the variables has the mean above 5.

Table 16. Friedman test for cross-section for unemployment model.

| Variables | Coef. | Std. error | z | p> z | [95% conf. interval] | |
|--|--|------------|-------|-------|----------------------|---------|
| GF | -0.0317 | 0.0123 | -2.57 | 0.010 | -0.0559 | -0.0075 |
| Inflation | 0.0205 | 0.0098 | 2.09 | 0.036 | 0.0013 | 0.0398 |
| LAB_F | 0.0179 | 0.0329 | 0.55 | 0.585 | -0.0465 | 0.0824 |
| TO | 0.0295 | 0.0056 | 5.23 | 0.000 | 0.0184 | 0.04054 |
| FDI | -0.0092 | 0.0121 | -0.76 | 0.446 | -0.0328 | 0.0144 |
| DC_PS | 0.0277 | 0.0132 | 2.09 | 0.036 | 0.0018 | 0.0536 |
| HDI | -3.7369 | 2.1083 | -1.77 | 0.076 | -7.8691 | 0.3953 |
| TNR | -0.0403 | 0.0243 | -2.82 | 0.005 | -0.0683 | -0.0123 |
| _Constant | 5.026 | 1.0014 | 5.02 | 0.000 | 3.0632 | 6.9888 |
| Sigma_u | 2.7479 | | | | | |
| Sigma_e | 1.1219 | | | | | |
| Rho | 0.8571 (Fraction of variance due to u_i) | | | | | |
| Friedman's test of cross-sectional independence = 6.224, Pr = 0.9757 | | | | | | |

Table 17. Friedman test for cross-sectional dependence for economic growth model.

| Variables | Coef. | Std. error | z | p> z | [95% conf. interval] | |
|---|--|------------|-------|-------|----------------------|---------|
| FDI | -0.1516 | 0.0426 | -3.55 | 0.000 | -0.2355 | -0.0676 |
| GCF | 0.1631 | 0.0466 | 3.50 | 0.001 | 0.0712 | 0.2549 |
| HDI | 22.1984 | 10.6093 | 2.09 | 0.037 | 1.3156 | 43.0813 |
| Inflation | -0.0699 | 0.0552 | -1.26 | 0.207 | -0.1787 | 0.0389 |
| LAB_F | -0.3988 | 0.1515 | -2.63 | 0.009 | -0.6969 | -0.1007 |
| TNR | 0.1809 | 0.0505 | 3.58 | 0.000 | 0.0816 | 0.2803 |
| DC_PS | -0.1511 | 0.0611 | -2.47 | 0.014 | -0.2713 | -0.0309 |
| _Constant | -9.2455 | 3.9374 | -2.35 | 0.020 | -16.9957 | -1.4954 |
| Sigma_u | 5.7147 | | | | | |
| Sigma_e | 3.8364 | | | | | |
| Rho | 0.6893 (Fraction of variance due to u _i) | | | | | |
| Friedman's test of cross-sectional independence = 19.697, Pr = 0.1839 | | | | | | |

Considering the fact that the probability values in Tables 16 & 17 are greater than 0.05, it suffices to say that there are no cross-sectional dependence among the countries in West Africa.