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Spatial Pattern of Unemployment in the ECOWAS Member States: A Panel Data Analysis Approach

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ABSTRACT

Background: The eighth Sustainable Development Goal aims to lower the unemployment rate. It is impossible to overstate the threat of unemployment. The majority of ECOWAS members are low-income nations that are severely impacted by this threat. The causes of unemployment are complicated and differ from nation to nation. However, understanding the drivers of unemployment in each nation can be accomplished by a spatiotemporal analysis of the factors affecting unemployment in ECOWAS states. The Panel data analysis was used to examine data on unemployment that covered a 30-year period from the World Bank database for Foreign Direct Investment, Gross Domestic Product, Gross Fixed Capital Investment, Inflation, Age Dependency Ratio, Population Growth, and Private Monetary Sector at 1%, 5% and 10% levels of significance. Several maptools and shapefiles were taken into consideration for the spatiotemporal analysis using the R-software, and the Rook rule was employed as a spatial weight. The Hausman tests showed that the random effect model is better. Fixed Direct Investment and Gross Domestic Product had a significant effect on unemployment. The spatial pattern of unemployment on the selected variables in the ECOWAS states was presented. To increase the competitiveness of the workforce in the labour market and draw more Foreign Direct Investment to generate more employment possibilities, governments and policymakers should concentrate on enhancing their workforce's skills and qualifications. Growing the Gross Domestic Product will result in a significant reduction in unemployment.

Keywords: ECOWAS, Fixed Direct Investment, Gross Domestic Product, Panel Data, Rook rule, Spatial weight, Unemployment

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1. INTRODUCTION

One of the top economic concerns for both developed and developing nations is the reduction of the rate of unemployment (ILO, 2020). The unemployment rate is a crucial macroeconomic factor that affects economic success and is an essential component of the economic policy of many nations, particularly developed nations.

It is important for policymakers and stakeholders because of its significant social and economic consequences, such as poverty, inequality, social unrest, and reduced economic growth. Siyan *et al* (2016) discovered that unemployment and inflation are two interconnected economic ideas. Over time, economists have attempted to determine how unemployment and inflation affect the level of poverty and what role government plays in reducing these factors. Undoubtedly, the government works to attain a number of macroeconomic objectives, including full employment, domestic price stability, and economic growth.

There is no consensus on the list of variables that determine unemployment. Even empirical research that agrees on the same list of drivers of unemployment cannot agree on how each variable influences unemployment, which further demonstrates that this issue is still open for debate. For instance, economic growth was found to reduce unemployment by Gaber (2018), Riaz and Zafar (2018), Folawewo and Adeboje (2017), Baah-Boateng (2016), Ebaidalla (2016), Maqbool *et al* (2013), Baah-Boateng (2014), whereas Alrayes and Wadi (2018), Kerckhoffs *et al* (1994) could not identify a clear link between economic growth and unemployment. Alrayes and Wadi (2018) found no evidence of a substantial relationship between inflation and unemployment, contrary to the findings of Folawewo and Maqbool *et al* (2013), Adeboje (2017), and Gaber (2018).

The relevance of unemployment to the Economic Community of West African States (ECOWAS) region is important. The ECOWAS states include Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. According to World Bank (2021), the unemployment rate in the ECOWAS region was 6.8% in 2019, but this varied widely across countries. For instance, the unemployment rate in Nigeria was 23.1%, while in Ghana, it was 6.7%. Unemployment is particularly high among young people, with an estimated 60% of the region's youth population unemployed or underemployed (World Bank, 2018). As a result of the potential for social unrest and political instability, the high rate of youth unemployment is a serious issue.

Unemployment is a challenge in the ECOWAS region that cannot be overemphasized, and addressing it requires a multifaceted approach. It is important to note that some individuals may experience multiple types of unemployment throughout their careers. Understanding the different types of unemployment is critical for policymakers and stakeholders to develop effective strategies to address unemployment and promote sustainable economic growth. High levels of unemployment in ECOWAS states contribute to poverty. According to the World Bank, more than 70% of the population in some West African countries lives on less than $2 per day (World Bank, 2021).

Unemployment impedes economic growth in ECOWAS states. According to the African Development Bank, unemployment rates above 10% can reduce economic growth by 2% to 3% (African Development Bank, 2021). It contributes to social unrest and political instability in ECOWAS states. For example, the high youth unemployment rate in Nigeria has been linked to social unrest and violence (BBC News, 2020). Unemployment in ECOWAS states can lead to brain drain, where skilled workers emigrate to other countries in search of employment opportunities. According to the United Nations, over 40% of highly skilled African migrants live outside the continent (United Nations, 2021).

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It can have negative health effects on individuals, including increased stress and mental health problems. According to a study in Nigeria, unemployed individuals had significantly higher levels of depression, anxiety, and stress than employed individuals (Olatunji et al., 2018). The effect of unemployment on increased crime rates cannot be overemphasized. According to a study in Nigeria, areas with high unemployment rates had higher rates of crime (Owolabi & Alabi, 2021).

The causes of unemployment in ECOWAS states are varied and complex, and they differ from country to country. A spatiotemporal analysis of the determinants of unemployment in ECOWAS states is a valuable approach to understanding the underlying causes of unemployment in the region. This analysis can help policymakers and stakeholders identify the most effective strategies for addressing unemployment in the region. Some of the factors that have been identified as contributing to unemployment in the ECOWAS region include a lack of adequate education and skills, inadequate infrastructure, political instability, corruption, and weak macroeconomic policies (Adenutsi and Korkpoe, 2017; International Monetary Fund, 2019).

Several works on the drivers of unemployment include (Mbekeni and Phiri. 2019, Batel and Choga. 2018; Raifu. 2017; Dagume and Gyekye, 2016; Batu, 2016; Fila *et al*. 2016; Baah-Boateng, 2016; Khumalo and Eita, 2015; Baah- Boateng, 2014; Kyei and Gyekye, 2011; Eita and Ashipala, 2010), Folawewo and Adeboje (2017) and Ebaidalla (2016). However, this study is set to look at the fixed and dynamic nature of the drivers of unemployment, hence the panel data analysis, as well as examine its spatial pattern in the ECOWAS states.

2. METHODOLOGY

2.1 The Model

The standard model is written as;

$$y_{it} = x_{it}\beta + z_i\alpha + \varepsilon_{it} \quad (1)$$

The explanatory variables of the model are organized into k vectors x_{it} with dimensions (1, k). The vector of unknown parameters β with (k, 1) dimension, α is the heterogeneity or individual-specific effect, z_i with a constant term and a set of variables unique, are constant overtime.

From equation (1) the pooled, fixed effect and random effect models can be written respectively as;

$$y_{it} = x_{it}\beta + \alpha + \varepsilon_{it} \quad (2)$$

$$y_{it} = x_{it}\beta + \alpha_i + \varepsilon_{it} \quad (3)$$

$$y_{it} = x_{it}\beta + \alpha + u_{it} \quad (4)$$

where $u_{it} = \alpha_i + \varepsilon_{it}$ and $\varepsilon_{it} \sim N(0, \sigma^2)$

2.1.1 Spatial Effect in Panel Models

The pooled data model can be written in spatial terms as;

$$y_{it} = \rho \sum_{i \neq j} w_{ij} y_{jt} + x_{it}\beta + \sum_{i \neq j} w_{ij} x_{jt}\theta + \alpha + u_{it} \quad (5)$$

$$u_{it} = \lambda \sum_{i \neq j} w_{ij} u_{jt} + \varepsilon_{it} \quad (6)$$

where, w_{ij} is a spatial weighting matrix W_N of dimension (N, N) in which neighbourhood relationships between sample individuals are defined.

From equation (6)

$$y_t = \rho W_N y_t + x_t\beta + W_N x_t\theta + \alpha + u_t \quad (7)$$

$$u_t = \lambda W_N u_t + \varepsilon_t \quad (8)$$

Where y_t is the vector with dimension (N, 1) observations of the variable explained for period t, x_t is the matrix (N, k) for observation on the regressors over period t.

In the fixed effects approach, spatial specifications could be used to explain spatial autocorrelation. The Spatial Autoregressive Model (SAR) can be written as;

$$y_{it} = \rho \sum_{i \neq j} w_{ij} y_{jt} + x_{it}\beta + \alpha_i + u_{it} \quad (9)$$

where $u_{it} \sim N(0, \sigma^2)$. Spatial interaction in this case is modelled through the introduction of the spatially lagged dependent variable $(\sum_{i \neq j} w_{ij} w_{jt})$. The Spatial Error Model (SEM) can be written as;

$$y_{it} = x_{it}\beta + \alpha_i + u_{it}$$
$$u_{it} = \lambda \sum_{i \neq j} w_{ij} u_{jt} + \varepsilon_{it} \quad (10)$$

The spatial interaction is captured with spatial autoregressive specification of the error term $(\lambda \sum_{i \neq j} w_{ij} w_{jt})$.

In this context, the SAR model which is treated as components of the error term is written as;

$$y_{it} = \rho \sum_{i \neq j} w_{ij} y_{jt} + x_{it}\beta + \alpha + u_{it}$$
$$u_{it} = \alpha_i + \varepsilon_{it} \quad (11)$$

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A generalized specification for SEM (Baltagi et al, 2007) is;

$$y_{it} = x_{it}\beta + u_{it}$$
$$u_{it} = \alpha_i + \lambda \sum_{i \neq j} w_{ij} u_{jt} + v_{it} \quad (12)$$
$$\alpha_i = \eta \sum_{i \neq j} w_{ij} \alpha_j + e_i$$

The regional spatial-effect is embodied by the spatial-weight matrix (W_{ij}), created by applying the "Rook" rule, which assumes an adjacency rule where

$$w_{ij} = \begin{cases} 1 & when \text{ region i and the region j are adjacent} \\ 0 & when \text{ region is and the region j are not adjacent} \end{cases}$$

The economic weight-matrix based on the binary weight matrix (Lin Guang-Ping, 2005) is given by

$$W^* = W * E, E_{ij} = \frac{1}{|\overline{y}_i - \hat{y}_i|} \quad (13)$$

where $\overline{y}_i = \frac{1}{t_1 - t_0 + 1} \sum_{t=t_0}^{t_i} y_{it}$

W is the weight-matrix of spatial location; E is the matrix of economic strength.

2.2 The Empirical Study

This study will use the panel data on the determinants of unemployment in the ECOWAS member states, which spans 30 years, obtained from the world bank website (http://data.worldbank.org) to carry out an extensive spatiotemporal analysis. The impact of Foreign Direct Investment (FDI), Gross Domestic Product (GDP), Gross Fixed Capital Investment (GFCF), Inflation (INFL), Age Dependency Ratio (ADR), Population Growth (PG), Monetary Sector Private (MSP) were considered on Unemployment (UNE).

3. RESULTS AND DISCUSSION

The results of the Spatial lag, random effects, spatial error correlation are presented.

3.1 Results

The average, minimum, and maximum values of the variables of interest in the study are shown in Table 1. The result shows that there is a random effect and no spatial autocorrelation based on the model fitted. The random and fixed effects were examined in Tables 3 and 4, but based on Hausman test in Table 2, it was shown that the random effect model is preferred. Table 3 indicates the coefficients values, spatial error parameter and the autoregressive coefficient.

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The coefficient values of the INFL, FDI, GDP, GFCF, ADR, PG, MSP are 0.5620, 0.0113, 0.0004, 0.0008, 0.0002, -0.0095,0.0382, and 0.0264 respectively. The result however shows that a unit increase in the foreign direct investment and gross domestic product will have a significant positive effect on UNE.

The error variance parameters presented in Table 3 measure the degree to which the error terms for adjacent observations are correlated. The result shows that there is weak evidence for the existence of spatial autocorrelation in the errors. The variance of the spatial error term measures the degree to which the error terms are spatially correlated after accounting for the spatial lag and random effects. There is evidence of spatial correlation in the errors that is not accounted for by the spatial lag and random effects. Figures 1 – 8 give a clear visualisation of areas affected by UNE in ECOWAS member states based on the selected variables.

Table 1: Descriptive Statistics

	Minimum	1st Qu.	Maximum	Mean	3rd Qu.	Median
UNE	.30	2.90	11.70	4.67	6.10	4.20
INFL	-13.90	1.20	72.80	7.82	10.73	4.65
FDI	-	15540698.0	8841062051.0	491151955.9	357589810.0	87759350.0
GDP	138.70	383.60	3098.99	743.77	855.70	606.35
GFCF	-294.20	.38	2357.70	13.89	16.85	8.30
ADR	67.40	86.20	111.90	91.02	97.05	89.70
PG	-1.90	2.50	7.90	2.74	3.00	2.70
MSP	.40	6.58	40.20	11.80	15.15	10.55

Table 2: Diagnostic Test of the Models

Test	Statistic	P-value	Remark
LM1 (Random Effect Test)	56.195	2.2e-16	There is a random effect
LM2 (Spatial autocorrelation test)	-2.6547	1.992	No spatial autocorrelation
Hausman	14.652	0.06627	The random effect model is

Table 3: Spatial Random Model Estimation

Coefficients				
Coefficients	Estimate	Std.Error	t – value	Pr (> |t|)
(Intercept)	0.5620	1.7786	3.1600	**0.0016****
INFL	0.0113	0.0065	1.6881	0.0914
FDI	0.0004	0.0001	-5.1166	**3.111e-07*****
GDP	0.0008	0.0002	3.4034	**0.0007*****
GFCF	0.0002	0.0005	-0.3117	0.7552
ADR	-0.0095	0.0173	-0.5474	0.5841
PG	0.0382	0.0791	0.4826	0.6294
MSP	0.0264	0.0136	1.9444	0.0518

Spatial Error Variance Parameter				
Phi	3.0731	1.1997	2.5617	0.0104
Rho	0.2350	0.1283	1.8308	0.0671
Spatial Autoregressive Coefficient				
Lambda	-0.2160	0.1431	-1.5088	0.1314

Table 4: Spatial Fixed Effects Model Estimation

Coefficients				
Coefficients	Estimate	Std.Error	t – value	Pr (> |t|)
INFL	0.0104	0.0065	1.5896	0.1119
FDI	-0.0005	0.00009	-5.1666	2.384e-07***
GDP	0.0008	0.00025	3.3805	0.000724***
GFCF	-0.0002	0.00049	-0.3193	0.7495
ADR	-0.0072	0.0175	-0.4118	0.6805
PG	0.0431	0.0779	0.5527	0.5805
MSP	0.0277	0.0136	2.0352	0.0418
Spatial Error Variance Parameter				
Rho	0.2369	0.2008	1.1798	0.2381
Spatial Autoregressive Coefficient				
Lambda	-0.2207	0.2308	-0.9563	0.3389

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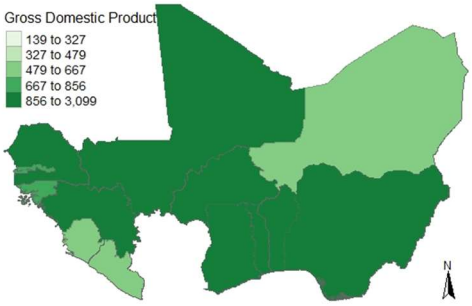

Fig 1: Spatial Percentage Distribution of GDP on UNE

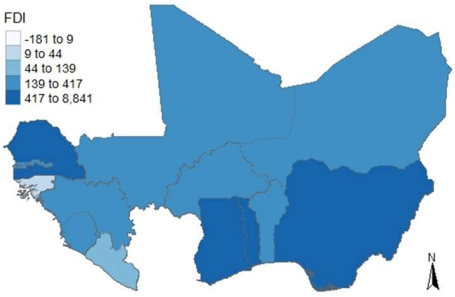

Fig 2: Spatial Percentage Distribution of FDI on UNE

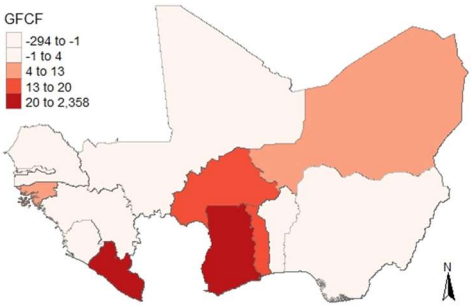

Fig 3: Spatial Percentage Distribution of GCFC on UNE

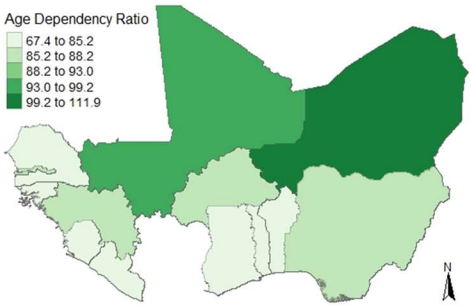

Fig 4: Spatial Percentage Distribution of AGR on UNE

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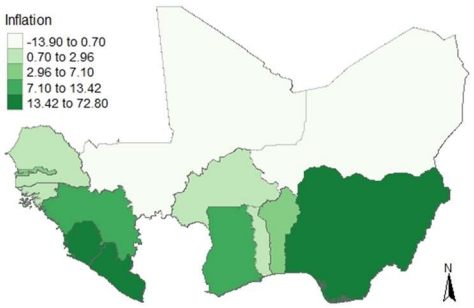

Fig 5: Spatial Percentage Distribution of Inflation on UNE

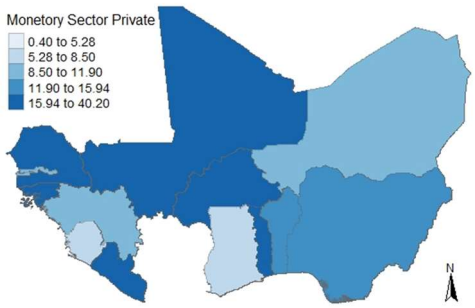

Fig 6: Spatial Percentage Distribution of MSP on UNE

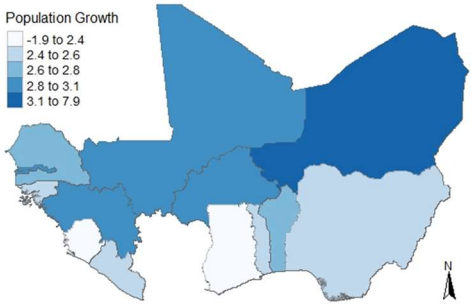

Fig 7: Spatial Percentage Distribution of PG on UNE

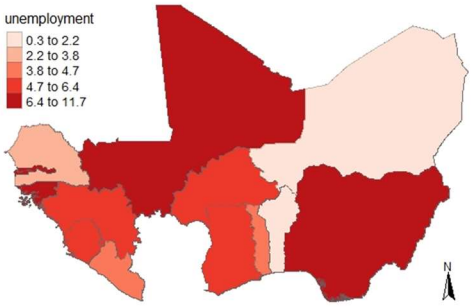

Fig 8: Spatial Percentage Distribution of UNE

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Fig 9: Labelled Map of ECOWAS States
(Source: http://ecowax.atspace.com)

3.2 Discussion of Results

The section is limited to the preferred random effect based on the Hausman test (Table 2). Oduro and Ntiamoah (2022), contrary to the expected negative impact, found that FDI has a positive impact on UNE, as it tends to create jobs that require high skills and qualifications, leaving low-skilled workers unemployed. This corroborates our findings which suggests that policymakers should focus on developing the skills and qualifications of their workforce to make them more competitive in the job market and attract more FDI to create employment opportunities. However, Amadou and Kafando (2021) in their study of the impact of FDI and human capital on UNE found that FDI has a negative significant impact on UNE rate, indicating that foreign investment creates job opportunities and reduces UNE.

Ayadi and Olabisi (2021) employed various financial development indicators such as private credit to GDP, domestic credit to GDP, stock market capitalization to GDP, and banking sector development index to measure the level of financial development in the region. Their findings of the study reveal that financial development has a significant impact on UNE in West Africa. This was attributed to the fact that a developed financial sector can provide more credit to entrepreneurs, which leads to more investment and job creation. Additionally, the study finds that the impact of financial development on unemployment is more pronounced in the long run compared to the short run. The study also suggests that policymakers in West African countries should focus on promoting financial sector development as a means of reducing UNE in the region. Although other variables were not significant. However, Oduro and Quartey (2019), found a negative impact of PG on UNE in Ghana which also supports our findings.

Specifically, it was argued that PG is likely to have a negative impact on UNE due to its negative effects on the demand for labour, the supply of labour, and economic growth. Njikam and Mbeleck (2018) showed that financial development measured by the ratio of domestic credit to private sector and the ratio of broad money to GDP have a negative impact on UNE by improving access to credit and funding for businesses, and facilitating investment in the economy as a means of reducing UNEs in the long run. Okun's law states that GDP must grow at about a 4% rate for one year to achieve a 1% reduction in the rate of UNE which supports our findings that growing GDP will bring drastic reduction to UNE.

4. CONCLUSION

The spatial distribution of unemployment across the selected variables in the ECOWAS states revealed the relationship between unemployment and factors such as foreign direct investment, gross domestic product, gross fixed capital investment, inflation, age dependency ratio, population growth, and the private monetary sector. The Hausman tests demonstrated the superiority of the random effect model. Unemployment was significantly impacted by fixed direct investment and gross domestic product. Governments and policymakers should focus on improving their workforce's skills and credentials in order to boost labour market competitiveness and attract more foreign direct investment, which will lead to the creation of more employment opportunities. There will be a huge decrease in unemployment as the Gross Domestic Product grows.

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