Panel Data Analysis of Economic Growth Determinants in Ecowas Region

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ABSTRACT

The study examined the Macroeconomic factors influencing Economic Growth in Economic Community of West African States region using panel data regression. A Pooled ordinary least squares, Fixed Effect Model, and Random Effect Model were implemented to fit the panel regression model for the panel data sets. The result showed that estimates from fixed effect model were accurate in determining the econometric relationship among the variables under study. According to fixed effect model chosen for the dataset under study, Foreign direct investment, Exchange rate, Export of goods and services and Inflation rate are statistically significant. The variables Foreign direct investment, Inflation rate and External debt have positive impact while the Exchange rate and Export of goods and services variables affect the Economic Community of West African States Countries negatively. Policy makers are therefore advised to erect anti-inflationary policies that attract Foreign Investors, emphasis should be laid on encouraging stable and reasonable exchange rate to promote even and sustainable Economic Growth.

Keywords: Panel data, ECOWAS, Economic Growth, Fixed Effect Model, and Random Effect Model.

INTRODUCTION

Economic growth is considered to be a powerful force for reducing poverty, diminish inequality and advance sustainable development goals (Ceesay *et al*., 2019). However, many West African nations have consistently struggled with sluggish economic growth rates, impeding their ability to attain significant success in international trade. Economic growth is a central objective for countries seeking to improve the standard of living and well-being of their citizens. Economic growth is one of the essential macroeconomic coverage targets in which countries all over the world persistently strive to achieve (Adewole 2023). Over the years, ECOWAS region has experienced various economic challenges and opportunities that influence its economic trajectory significantly. Fluctuations in key macroeconomic variables indicators has not only destabilized the economy but also impeded the realization of long-term growth objectives. The Economic Community of West African States (ECOWAS) encompasses sixteen member countries, making it the largest regional integration organization in terms of population size on the African continent.

The member countries include Cape Verde, The Gambia, Ghana, Guinea, Liberia, Nigeria, and Sierra Leone (Non-CFA countries), as well as Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo (CFA countries). (Ige and Odularu, 2007) ascertained in their work that over half of the population within ECOWAS, approximately 115 million individuals, or 51 percent, resides in absolute poverty, surviving on less than one US dollar per day. This study conducts an econometric analysis to examine the impact of some key macroeconomic variables, which includes foreign direct investment, the

exchange rate, industrialization, the inflation rate, export of goods and services and the external debt on the economic performance in West Africa countries using panel data. These variables were chosen based on the crucial roles they played in influencing the overall economic performance of the ECOWAS region; the selected predictors are some of the powerful instruments for upgrading developing nations from their current economic status. For instance, Foreign direct investment (FDI) signifies a major component of capital inflow for developing nations, and its impact on economic growth is a subject of extensive debate. However, most researchers agree that its benefits outweigh its costs to the economy (Musila, 2003). FDI encompasses various growth-enhancing attributes such as technology transfer and access to international markets. Nonetheless, for a host country to fully harness and retain these benefits, it must meet specific prerequisites, which not all emerging markets possess (McAleese, 2004).

Industrialization refers to the transformation of an economy through increased industrial activity and manufacturing expansion. In broader terms, industrialization can be described as an increase in the non-agricultural and non-service sectors' contribution to GDP through a series of economic processes linked with more effective methods of value creation (Simandan, 2009). Baumol *et al*., (2019) explore the concept of productivity convergence, suggesting that nations with lower productivity levels often experience faster growth rates, thereby reducing the productivity gap with more advanced economies. External debt is one of the main economic challenges facing west African countries. Debt servicing creates problems for developing countries since the amount needed in servicing the debt is always greater than the real amount borrowed. Gohar *et al*. (2012). Numerous studies have investigated the influence of external debt on economic growth, with many specifically examining the existence of "debt-overhang" or "crowding out" effects. Scholars such as (Reinhart *et al*., (2012) and Epaphra And Mesiet(2021) among others, have contributed to this body of research.

Moreover, Inflation has consistently posed a significant concern for governments and policymakers due to its adverse impact on economic stability, particularly hindering economic growth. The primary aim of many economies' in implementing economic policies is to achieve robust and steady economic growth while keeping inflation low and manageable. Inflation, characterized by a general increase in the prices of goods and services, often stems from imbalances in supply and demand (Otoakhia (2021)). The stability of a nation's foreign exchange rate plays a pivotal role in determining its economic performance. The viability of its economy hinges on the exchange rate of its local currency relative to others worldwide. The exchange rate serves as a dynamic tool for assessing the overall economic health, as highlighted by Adewole (2024). Gross domestic product, serves as a widely-used measure of economic activity within a country and is a key indicator of its progress and development. Bekele and Degu (2021) highlight that individual sector contributions to GDP, along with the perspective and productivity of the financial sector, significantly impact a country's economic growth. Cieślik and Łukasz (2018) note that in developing countries, there is often a decrease in registered GDP, particularly in nations experiencing a significant downturn in economic activity. They emphasize that more than half of the decline in official GDP is attributable to reduced overall economic activity.

Academic, professional, and international organizations have shown growing interest in research studies utilizing data from ECOWAS countries, driven by the economic growth prospects within these nations. Consequently, a multitude of studies have delved into the phenomenon of economic growth using data from ECOWAS countries, as evidenced by research conducted by Lloyd *et al.*,(2014), Sane (2016), N'Zue, (2020) and others. The primary objective of this study is to enhance the current body of knowledge on the relationship between economic growth and selected microeconomic variables in the ECOWAS region. This research seeks to analyze the causal linkages between these variables and economic growth employing panel data analysis. The study holds significance as it delves into the determinants of economic growth in specific ECOWAS countries, offering insights that can inform policymakers and provide recommendations for strategic interventions. Panel data, as outlined by Agus Widarjono (2009) and Hsiao (2014) is a regression approach that combines time series and cross-sectional data. This approach offers several advantages, including more data volume leading to greater degrees of freedom, mitigation of issues arising from omitted-variable problems, minimizing the bias potentially caused by aggregating individual data, and explicit accounting for individual heterogeneity by incorporating individual-specific variables into econometric equations.

2.0 Literature review

Economic growth can be termed as a continuous development in a country's ability to meet the demand of consumer for products and services as a result of higher productivity in volumes. Olorogun *et al.*, (2022), Caliskan, (2015) described economic growth as steady rise transpiring in the production and consumption of goods and services within an economy. This growth metric is prominently featured in various growth theories, including the Solow growth model and endogenous growth theory. It has been extensively applied in empirical studies on economic growth (e.g., Agosin, 2007; Adamu et al., 2012). A review of the current literature offers an overview of the determinants affecting economic growth in the countries of the Economic Community of West African States (ECOWAS). ECOWAS, a regional organization founded in 1975, comprises 15 countries and aims to enhance economic trade, foster national cooperation, and establish a monetary union across West Africa.

Huge empirical studies have been conducted in investigating how some key macroeconomic affect economic growth of Economic Community of West African States. Esso (2010) revisited the cointegrating and causal relationship between financial development and economic growth in ECOWAS countries from 1960 to 2005. His analysis revealed a positive long-term relationship between financial development and economic growth in most ECOWAS nations, suggesting that financial reforms could stimulate economic growth. In terms of governance, foreign direct investment (FDI), and economic growth in ECOWAS, Raheem and oyinlola (2013) examined the interactive effect of governance on FDI in seven ECOWAS countries using Ordinary Least Squares (OLS) and Threshold Auto-Regressive (TAR) techniques. Using panel data spanning from 1970 to 2010, Raheem and oyinlola's findings indicated that FDI is positively related to economic growth under both static and dynamic conditions in the OLS models.

Additionally, government consumption, balance of payments (BOP), and governance were found to significantly contribute to economic growth in these seven ECOWAS

countries. Yelwa and Diyoke (2013) investigated the statistical relationship between the export and economic growth amongst some selected ECOWAS countries. Their aim was to examine whether or not export-led growth is indeed potent enough to drive her economic growth as an alternative to foreign direct investment from the period of 1980 to 2011, using panel model analysis. They discovered a stable export-driven growth among these selected countries, and showed that export-led growth in the region is potentially able to drive economic growth. Adamu (2013) analyzed the influence of foreign aid on economic growth in ECOWAS states using a three-equation simultaneous model and panel data from 1990 to 2009. The study concluded that foreign aid has a strong and positive effect on economic growth.

Chirwa and Odhambo (2016) reviewed literature on the determinants of economic growth in both developed and developing countries using ARDL bounds testing approach.. They found that in developed countries, the primary macroeconomic determinants include physical capital, fiscal policy, human capital, trade, demographics, monetary policy, and financial and technological factors. In contrast, in developing countries, the main determinants are foreign aid, foreign direct investment, fiscal policy, investment, trade, human capital development, demographics, monetary policy, natural resources, reforms, as well as geographic, regional, political, and financial factors. Iyoha and Okim (2017) econometrically examined the hypothesis of a positive relationship between trade and growth in ECOWAS countries during the 1990-2013 period using panel data regression analysis. Their results revealed that exports, exchange rate and investment were significant determinants of per capita real income growth in ECOWAS countries. Cheong & Junjun

(2018) examined the effect of foreign direct investment (FDI) on economic growth in ECOWAS Countries during the period of 1995 to 2015 using panel data approach- fixed effect and random effect models. The empirical results showed that foreign direct investment was statistically significant and had positive relationship with economic growth in ECOWAS sub-region.

Ashakah and Osakwe (2019) investigated the impact of foreign direct investment (FDI) on economic growth in Economic Community of West African States (ECOWAS) sub-region, using fixed effects and random effects models covering the period of 2007 to 2016. Their empirical results revealed that foreign direct investment (FDI) are positively related to the growth rate of gross domestic product. Aderemi and Isreal (2022) considered an empirical analysis of effect of capital and trade openness on economic growth of Economic Community of West African States Countries using panel data with autocorrelation and heteroscedacity. Their results revealed an insignificant influence of capital and trade openness on economic growth of the fifteen countries of ECOWAS region. The impact of the aforementioned macroeconomic variables on ECOWAS region economic growth remains inconclusive, as there is no consensus in the literature regarding their significant relationship. This research seeks to enhance the current body of knowledge by analyzing the joint dynamic relationship between the exchange rate, foreign direct Investment, Industrialization, Export of goods and services, inflation Rate and the economic growth in the ECOWAS region employing panel data analysis.

MATERIALS AND METHODS

Data Description

The data for this study were obtained from a secondary source extracted from the World

Development Indicators (WDI) from the World Bank database for the period of 2000 to 2022. . 12 countries were selected in the ECOWAS region as follows: Benin, Cote d'ivoire, Gambia, Niger, Nigeria, Mali, Senegal, Sierra-Leone, Togo, Burkina Faso, Ghana, Guinea, and Guinea-Bissau. The sample selections were based on the nations' economic contributions, geographic representation, and data reliability. The data set of the variables includes; economic growth proxy by GDP, the exchange rate, foreign direct Investment, Industrialization, Export of goods and services, and inflation Rate. The

study employed panel data regression in modeling the data. GDP growth proxy by GDP growth (annual %) is the dependent variable while the exchange rate, Foreign direct Investment, Industrialization, Export of goods and services, and inflation Rate as a share of GDP are the independent variables. These predictors were chosen based on their crucial roles they played in influencing the overall economic performance of the country,

Considering the general form of panel data regression model expressed as follows in equation (1) below

$$Y_{it} = \alpha + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + , ..., + \beta_n x_{nit} + \mu_{it}$$

(1)   = 1,2,…,m and   = 1,2,…,   represents the number of cross section data and the amount of time series data respectively,   is defined as the intercept coefficient while $\beta_1, \beta_2, \beta_3, ..., \beta_n$ denotes the slope coefficient with the predictor variable and μ_{it} is the regression error from the   -th data at the   -th time.

Panel Data Unit root Test

The research adopted Im, Pearson and Shin (2003) unit root test. Im etal (2003) is based on the cross sectional independence

assumptions. The test employs independent unit root tests for every cross-sectional entity. Im etal (2003) unit root test allows the heterogeneity in the value of i under the alternative hypothesis.

Considering testing for the existence of unit roots in the following panel data:

$$y_{it} = \rho_i y_{it-1} + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{it-j} + \varphi z_{ij} + \varepsilon_{it} \qquad (2)$$

It tests the following hypothesis;

$H_0: \rho_i = 1$ for $all\ i$

$H_1: |\rho_i| < 1$ for at least one i

The Im etal (2003) is based on an average of the individual Augmented Dickey Fuller test statistics defined as

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_{\rho_i} \qquad (3)$$

Where t_{ρ_i} is an individual t- statistics for the null hypothesis test.

Panel Data Estimation Methods

Common Effect Model (CEM)or the pooled least square: The CEM method is a panel data model approach that assumed that the behavior of data for each individual is the

same in various time periods., the method uses the same α for each individual and at all times. Ordinary Least Square (OLS) approach can be used for estimating parameters in the CEM method. The regression equation using the CEM approach can be stated as follows:

$$Y_{it} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + , ..., + \beta_n x_n + \mu_{it} \tag{4}$$

Fixed Effect Model (FEM) or the least square dummy variables (LSDV) model: This model used the assumption of accommodating differences between individuals from different intercept. Estimation of Fixed Effects model panel data employs a dummy variable technique in capturing differences between intercept. Such estimation models are often referred to as the Least Squares Dummy Variable technique or abbreviated LSDV. The Fixed effect model differs from the common effect, but still uses the ordinary least square principle. The regression equation of fixed effects model for panel data is expressed as follows;

$$Y_{it} = \alpha_i + \beta' x_{it} + \mu_{it} \tag{5}$$

for i = 1,2, ..., M and t = 1,2, ..., K. where M = number of individuals or cross section and K = the number of time periods.

Random Effect Model (REM): The method assumes that there are differences in intercept for each individual. The method is often called error component models because it consists the overall model error and individual error. The overall model error is a mixture of time series data and cross section, while individual errors are errors generated from each cross-section data. This method can be expressed considering the equation below:

$$Y_{it} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + , ..., + \beta_n x_n + \mu_{it} + \varepsilon_i \tag{6}$$

μ_{it} is the residual of combination of both cross section and time series while ε_i denotes the error component of the cross-section data, it represents the individual residual which is the random characteristic of unit observation at all times.

Equation (6) can be simplified as

$$Y_{it} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + , ..., + \beta_n x_n + \theta_{it} \tag{7}$$

Where $\theta_{it} = \mu_{it} + \varepsilon_i$

The error component models make use of the following assumptions;

$$\varepsilon_{i \sim N(0, \sigma_\varepsilon^2)} \tag{8}$$

$$\mu_{it} \sim N(0, \sigma_u^2)$$

$$E(\varepsilon_i \mu_{it}) = 0 \tag{9}$$

There is no correlation between the individual error components and also no autocorrelation across both cross section and times series units.

$$E(\theta_{it}) = 0 \tag{10}$$

$$Var(\theta_{it}) = \sigma_\varepsilon^2 + \sigma_u^2 \tag{11}$$

The covariance elements

$$Cov(\theta_{it,}\theta_{js,}) = E(\theta_{it,}\theta_{js}') \tag{12}$$

Equivalent to $\sigma_\varepsilon^2 + \sigma_u^2$ If i=j and t=s , also σ_ε^2 if i=j and t$\neq$ s
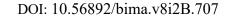
The covariance structure of composite error

$$\sum = E(\theta_{i,}\theta_j) \tag{13}$$

for individual i.

The variance – covariance matrix of the residual is

$$\Sigma_{T \times T} = \begin{bmatrix} \sigma_\varepsilon^2 + \sigma_u^2 & \sigma_\varepsilon^2 & \cdots & \sigma_\varepsilon^2 \\ \sigma_\varepsilon^2 & \sigma_\varepsilon^2 + \sigma_u^2 & \cdots & \sigma_\varepsilon^2 \\ \cdots & \cdots & & \\ \sigma_\varepsilon^2 & \sigma_\varepsilon^2 & \cdots & \sigma_\varepsilon^2 + \sigma_u^2 \end{bmatrix} \text{ and } V_{nT \times T} = \begin{bmatrix} \Sigma & 0 & \cdots & 0 \\ 0 & \Sigma & \cdots & 0 \\ 0 & 0 & \cdots & \Sigma \end{bmatrix} \quad (14)$$

A random effect model is estimated by generalized least squares (GLS) when the covariance structure is known, and by feasible generalized least squares (FGLS) or estimated generalized least squares (EGLS) when the covariance structure of composite errors is unknown. Since Σ is often unknown, FGLS/EGLS is more frequently used than GLS.

Panel Data Model Estimation Test

The best approach of the panel data regression model selection is determined by employing the Chow test, Hausman test, and Lagrange multiplier test

Chow test

The Chow test is employed in selecting the best models between the Common Effect Model and the Fixed Effect Model. The test statistic is expressed as;

$$\text{Chow test} = \frac{(SSE_1 - SSE_2)(nM - n - T)}{SSE_{(n-1)}} \quad (15)$$

where SSE_1 is the sum square error of the common effect model, SSE_2 is the sum of square error of the fixed effect model, is the number of individuals, M denotes the number of multiplications of the time series by cross section, and T is the number of independent variables. Chow test uses the approach of rejecting the null hypothesis if $>$ and accept if otherwise. The hypothesis is;

$H_0: \alpha_1 = 2, \dots, = \alpha_n = 0$

$H_1: \alpha_1 \neq 0, i = 1, 2, \dots, n$

Hausman Test

It is a statistical test employed to choose select the most appropriate model between Fixed Effect or Random Effect model in estimating panel data. Hausman test compares fixed and random effect models under the specification of the null hypothesis that individual effects are uncorrelated with any regressor in the model (Hausman (1978)),

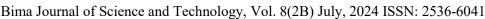$$L_M = \hat{p}'(Var(\hat{p}'))^{-1}\hat{p} \sim \chi^2(k) \quad (16)$$

Where $\hat{p} = (\hat{\beta}_{FEM} - \hat{\beta}_{REM})$ \quad (17)

Combining equation (#) and equation (%) together we have,

$$L_M = (\hat{\beta}_{FEM} - \hat{\beta}_{REM})'[var(\hat{\beta}_{FEM} - \hat{\beta}_{REM})^{-1}(\hat{\beta}_{FEM} - \hat{\beta}_{REM}) \sim \chi^2(k) \quad (18)$$

where $\hat{\beta}_{FEM}$ represent the slope estimation vector of the fixed effect model and $\hat{\beta}_{REM}$ denotes the slope estimation vector of the random effects model. The test statistic follows the chi squared distribution with k degrees of freedom. Hausman test examines if the random effects estimate is insignificantly

different from the unbiased fixed effect estimate. It tests with the following hypothesis;

H_0 : appropriate Random Effect Model.

H_1: Equivalence Fixed Effect Model.

If the Hausman test results accept the null hypothesis, it indicates that the best model to

use is the Random Effect Model. However, if the results states otherwise, the suitable model is Fixed Effect Model.

Lagrange Multiplier Test: is an analysis that determines the best method in estimating panel data regression with common effect or random effect. The test statistics is expressed below;
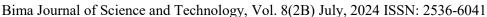
$$L_M = \frac{nT}{2\,(T-1)} \left[\frac{\sum_{i=1}^{n} \left(\sum_{t=1}^{T} \varepsilon_{it} \right)^2}{\sum_{i=1}^{n} \sum_{t=1}^{T} \varepsilon_{it}^2} - 1 \right]^2 \sim \chi^2(1) \tag{19}$$

The Lagrange multiplier test uses the hypothesis;
H_0 : $\sigma_e^2 = 0$
H_1 : $\sigma_e^2 \neq 0, i = 1,2, \dots, n$

Acceptance of null hypothesis shows that the Common Effect Model is more appropriate than the Random Effect Model and otherwise

if the null hypothesis is rejected. The LM statistic follows the chi-squared distribution with one degree of freedom.

RESULTS AND DISCUSSION

Table 1: Descriptive statistics

Variable	GDP	FDI	EXC .RT	INDUSTN	INF RT	EXP RT	EXT. DT
Max	26.4	32.414	9936.5	34.247	41.5095	10200000644	175.8903
Min	-20.5	-0.8402	0.5449	4.4287	-3.5025	74507964	1.240649
Mean	4.679	3.0833	847.04	20.557	6.5213	824874190	30.60541
Median	4.7	2.0287	494.79	20.837	4.4025	2179532100	25.396
St. Dev.	3.892	3.4800	1776.2	6.5912	7.2622	1763496317	23.5561
Skewnes	-0.014	3.4162	3.7937	-0.1157	1.7632	3.468986	3.106531
Kurtosis	13.50	23.150	16.844	2.5838	7.3174	15.24873	16.53688
J.Bera	1268.3	5206.3	2865.6	2.6078	357.377	2278.919	2551.267
Prob.	0.0023	0.0000	0.0000	0.2714	0.0000	0.0000	0.0000
Obs	276	276	276	276	276	276	276

The descriptive statistics of the macro-economic variables under consideration were analyzed in Table 1, the macroeconomic variables under studies include GDP, foreign direct Investment(FDI), the exchange rate(EXC RT), industrialization(INDUSTN), Inflation rate(INF RT), export of goods and services(EXP RT) and the external debt(EXT DT) of the selected 12 west Africa countries ranging from year 2000 to year 2022. From Table 1, it was revealed that the series display a high level of consistency as their mean and median fall persistently within the maximum and the minimum bounds of these series. The relatively low values of the standard deviation for most of the series imply that their mean deviations from the actual mean values are very small. For virtually all the data series, it is observed that the values of mean and median and mode are very close suggesting that the distribution is near symmetry. Also, the probability that the Jarque-Bera statistics exceed the observed values is averagely low for all the data series, thus the hypothesis of normality is rejected at 5 per cent significance level.

Table 2: Correlation Matrix

Variables	GDP	FDI	EXC RT	INDUSTN	IMP RT	EXP RT	EXT DT.
RGDP	1						
FDI	-0.0169	1					
EXC RT	0.7259	0.3923**	1				
Industrialzn	-0.6481	0.2749**	0.0251**	1			
INF RT	0.5023**	-0.044**	-0.169**	-0.5277**	1		
EXP RT	-0.9824**	0.0024**	0.1160**	-0.0428**	0.2116**	1	
EXT Debt.	-0.3331**	0.0056**	-0.076**	-0.3165**	-0.225**	0.3826***	I

NOTES: Dependent Variable: RGDP, *, and ** represent statistically significant at the 1%, and 5%, respectively

Table 2 showed the correlation analysis among the macroeconomic variables. The correlation between Real Gross Domestic Product (RGDP) and foreign direct Investment revealed a negative and low level of correlation between the variables but not statistically significant. However, an average positive and significant correlation exists between foreign direct Investment and the consumer Price Index, likewise in the exchange rate.

Moreover, the correlation that exists between industrialization and Real Gross Domestic Product reveals a negative and significant relationship; also, there is a negative relationship between the RGDP and the external debt in West Africa.

Table 3: Panel unit root test

Variables	Value	Prob.	Remark
RGDP	-3.1632	0.0025	I(0)
FDI	-2.9907	0.0016	I(0)
EXC RT	-2.3781	0.0022	I(0)
Industrialization	-3.1190	0.0003	I(0)
INF RT	-3.2726	0.0010	I(0)
EXP RT	-2.9824	0.0024	I(0)
EXT Debt.	-3.3331	0.0056	I(0)

Table 3 shows the result of Panel unit root test employing the methodology of Im, Pasaran and Shin (2003) panel unit root analysis to study the stationarity properties of the macroeconomic variables of the selected countries in determining their economic growth.

The results in Table 3 showed that the GDP, foreign direct Investment, the exchange rate, industrialization, the Inflation rate, export of goods and services and the external debt are all stationary at levels, indicating the variables are integrated of order (0). This result from the panel unit root does not give room for panel co-integration test.

Table 4: Pooled Effect

Variables	Coefficient	Std. Error	t- stat	Prob.
C	7.2480	0.0156	2.4178	0.0032
FDI	0.5138**	0.0261	0.6864	0.0041
EXC RT	-0.1632**	0.4167	-3.8420	0.0000
Industrialization	-0.2073	0.0221	8.8832	0.0007
INF RT	0.6529**	0.0145	3.1175	0.0000
EXP RT	-0.3371**	0.3179	2.9616	0.0029
EXT Debt.	0.7149	0.0174	5.8521	0.0000

R^2: 0.7816, $Adj\ R^2$: 0.7924, F- Stat.: 24.30,Prob (F- Stat.): 0.0000, Obs: 276, Group: 12.

NOTES: Dependent Variable: RGDP, *, and ** represent statistically significant at the 1%, and 5%, respectively

Table 4 depicts the regression coefficients modeling the impact of selected factors on economics growth of West Africa Countries using Panel data. Table 4 revealed that the Real Gross Domestic Product (RGDP), foreign direct investment (FDI), the exchange rate, industrialization, the Inflation rate, export of goods and services and the external debt were significant at 5% level in Pooled OLS estimation. The pooled effect model in Table 4 showed that, the consumer price Index, foreign direct investment (FDI) and the external debt have positive and significant effect on Real GDP while export of goods and services and the exchange rate have negative and significant effect on the economic growth. However, industrialization is seen to be negative and insignificant.

Table 5: Fixed Effect

Variables	Coefficient	Std. Error	t- stat	Prob.
C	3.2567	0.2688	6.3341	0.0000
FDI	0.3215**	0.0532	0.7368	0.0000
EXC RT	-6.1831**	0.0257	-6.2384	0.0001
Industrialization	-5.2722	0.6102	4.9038	0.0000
INF RT	0.6866**	0.2040	-5.7433	0.0000
EXP RT	-0.9423**	0.0391	3.0452	0.0018
EXT Debt.	0.5197	0.0441	8.3725	0.0000
R^2: 0.8278, $Adj\ R^2$: 0.8533, F- Stat.: 36.73, Prob (F- Stat.): 0.0000, Obs: 276, Group: 12.				

NOTES: Dependent Variable: RGDP, *, and ** represent statistically significant at the 1%, and 5%, respectively, Table 5 gives the estimates of fixed effect coefficients in modeling the impact of some selected key macroeconomics variable that determined the economic growth in West Africa using panel data. From the Table, the model estimates revealed that foreign direct investment, exchange rate and Inflation rate are good explanatory variables in determining the economic performance in selected West Africa countries. This result is reflected from the significance of the variables at 5%. However, from the model in Table 5, industrialization, and the external debt are insignificant at 5% level in fixed effect model estimation. Industrialization is observed to be negative and insignificant.

Table 6: Random Effect

Variables	Coefficient	Std. Error	t- stat	Prob.
C	3.1902	0.2585	6.3686	0.0065
FDI	0.3683**	0.0325	0.7520	0.0000
EXC RT	-6.7821**	0.0270	-4.8366	0.0000
Industrialization	5.0364	0.6426	4.5490	0.0000
INF RT	0.7252**	0.2342	-4.9613	0.0000
EXP RT	-0.8619**	0.0470	2.8833	0.0000
EXT Debt.	0.5281	0.0349	8.2719	0.0004
R^2: 0.7718, $Adj\ R^2$: 0.7990, F- Stat.: 52.19, Prob (F- Stat.): 0.0000, Obs: 276, Group: 12.				

NOTES: Dependent Variable: RGDP, *, and ** represent statistically significant at the 1%, and 5%, respectively

Table 6 shows the result of the random effect model of impact of foreign direct investment, the exchange rate, industrialization, the Inflation rate, export of goods and services and

the external debt on the economic performance in West Africa countries. The results also shows that the of foreign direct investment, consumer price index, the exchange rate and the export of goods and services has a positive and significant impact on economic performance in West Africa. Other variables such as industrialization and external debt were not significant at 5% level.

Table 7: Panel data Model Estimation Test Results

Breusch Pagan LM Test	2461.27**(0.0000)
Hausman Test	12.4629**(0.0000)
Obs	276
Group	12

The statistical significance of Breusch-Pagan LM test results in Table 7 revealed that the random effect model is more appropriate in modeling West African economic the data set than the pooled effect model. Also, to avoids models being devoid of any correlated random cross-sectional effect, Table 7 showed the applicability of Hausman test in determining the appropriate model between the Random effect and Fixed effect models, according to the statistically significant result of the test statistic, Fixed effect model was shown to be more appropriate. Hence, results from the fixed effect model were adopted as basis for the interpretation of the relationship between the GDP and the explanatory variables in the models examined for the study.

DISCUSSION

Virtually all the data series was observed to have very close values of mean and median, this implies that the distribution is near symmetry. Also, the probability that the Jarque-Bera statistics exceed the observed values is averagely low for all the data series.

There is negative and low level of correlation between the Real Gross Domestic Product (RGDP) and foreign direct Investment but not statistically relevant, whereas, an average positive and significant correlation exists between foreign direct Investment and the consumer Price Index, and also with the exchange rate. Model estimates for pooled regression, fixed effects and random effects were presented via the empirical analysis while the Breusch Pagan LM Test and Hausman test were employed for choosing the appropriate panel model. The significance of Hausman test in Table 7 revealed the appropriateness of fixed effect model in modeling the relationship between Nigeria foreign direct Investment, the exchange rate, industrialization, the Inflation rate, export of goods and services, the external debt and GDP. Hence, results from the fixed effect model were adopted as basis for the interpretation of the relationship between the GDP and the explanatory variables in the models examined for the study.

CONCLUSION

The research investigated the heterogeneity of the selected West African countries in terms of their key macroeconomic variables in predicting their economic growth, the relationship of these predictors with Gross domestic product were examined over time ranging from year 2000 to 2022 using Panel data analysis. Also, Panel Unit Root analysis was carried out on each of the variables to examine the stationarity of the data set across the selected countries. Model estimates for pooled regression, fixed effects and random effects were presented via the empirical analysis while the Breusch Pagan LM Test and Hausman test were employed for choosing the appropriate panel model. The result shows that estimates from fixed effect model were accurate in determining the econometric relationship among the variables under study.

According to fixed effect model chosen for the dataset under study, foreign direct investment, exchange rate, export of goods and services

and Inflation rate are statistically significant. The variables foreign direct investment, Inflation rate and external debt have positive impact while the exchange rate, and export of goods and services variables affect West Africa Countries negatively. Also, Industrialization is observed to be negative and statistically insignificant. The research revealed that foreign direct investment, Inflation rate, external debt, official exchange rate to other currencies globally and Export of goods and services plays major determinant of economic advancement in ECOWAS region of Africa continents.

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