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DOES ASYMMETRIC NEXUS EXIST BETWEEN EXPORT AND ECONOMIC GROWTH IN AFRICA?

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Abstract

This study ''does asymmetric nexus exist between export and economic growth in West Africa? Investigated the impact of economic indicators on economic growth in selected West African countries, namely Nigeria, South Africa, Ghana, Côte d'Ivoire, Benin, Burkina Faso, Guinea-Bissau, Liberia, Mali, and Niger. The study utilizes a Nonlinear Autoregressive Distributed Lag (NARDL) model to capture both the short-term and long-term asymmetric effects of key variables, including exports (EPO), foreign direct investment (FDI), exchange rates (EXR), and inflation (INF), on economic growth (GDP). The findings from individual countries like Nigeria, South Africa, Ghana, and others highlight distinct dynamics. For instance, Nigeria's reliance on past GDP performance and the mixed effects of exports and FDI suggest a need for focused economic reforms. South Africa's significant export performance and the delayed impacts of FDI indicate the importance of fostering a stable investment climate. Ghana's growth trajectory, heavily influenced by agricultural exports, emphasizes the need for policies that bolster these sectors. Meanwhile, countries like Liberia and Burkina Faso demonstrate the critical need for managing inflation and ensuring exchange rate stability to support growth.In conclusion, the NARDL model results reflect complex interrelationships among GDP, exports, FDI, exchange rates, and inflation across West African countries. Policymakers must create conducive environments for investment, manage inflation effectively, and enhance export competitiveness to foster sustainable growth. Tailored

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policies that consider the unique dynamics of each country will be essential for advancing economic development in the region. This comprehensive understanding of the economic landscape can guide future strategies aimed at achieving long-term stability and prosperity.

Introduction

Economic growth remains a primary objective for policymakers in West Africa, a region characterized by diverse economic structures, abundant natural resources, and a rapidly growing population. One of the key drivers of economic growth in the region is international trade, particularly exports. Traditional economic theories, such as the neoclassical and endogenous growth models, emphasize the crucial role of exports in fostering economic expansion through mechanisms such as increased foreign exchange earnings, technology spillovers, and economies of scale (Balassa, 1978; Romer, 1990). However, the relationship between exports and economic growth is complex and may not always be linear or symmetric, raising questions about the presence of an asymmetric nexus.

The relationship between export and economic growth has been a topic of interest in the field of international trade and economic development. The export-led growth (ELG) hypothesis, which suggests that export growth is a key driver of economic growth, has been widely debated (Krueger, 1978; Bhagwati, 1978). While some studies have found a positive relationship between export and economic growth (e.g., Feder, 1983; Balassa, 1978), others have found mixed or inconclusive results (e.g., Jung & Marshall, 1985; Dodaro, 1993).

In recent years, the concept of asymmetric nexus has gained attention in the literature. Asymmetric nexus refers to the idea that the relationship between two variables is not symmetric, meaning that the effect of one variable on the other variable is different depending on the direction of the change (Shin et al., 2014). In the context of export and economic growth, an asymmetric nexus would imply that the impact of export growth on economic growth is different from the impact of economic growth on export growth.

West Africa, a region with a growing economy and increasing trade activities, provides an interesting case study for examining the asymmetric nexus between export and economic growth. The region has experienced significant economic growth in recent years, driven in part by increases in export earnings (AfDB, 2020). However, the relationship between export and economic growth in West Africa is not well understood, and there is a need for further research on this topic.

This study aims to investigate the asymmetric nexus between export and economic growth in West Africa. Using a panel dataset of 10 West African countries over the period

1980 to 2023, this study employs Nonlinear Autoregressive Distributed Lag (NARDL) model to examine the asymmetric relationships between export and economic growth. The findings of this study will contribute to the existing literature on the ELG hypothesis and provide insights into the complex relationships between export and economic growth in West Africa.

Despite the growing importance of international trade in promoting economic growth and development, the relationship between export and economic growth in West Africa remains unclear. While some studies have found a positive relationship between export and economic growth, others have found mixed or inconclusive results.

The export-led growth (ELG) hypothesis, which suggests that export growth is a key driver of economic growth, has been widely debated. However, most of the existing studies have focused on the symmetric relationships between export and economic growth, ignoring the possibility of asymmetric nexus.

The lack of understanding of the asymmetric relationships between export and economic growth in West Africa is a significant research gap. This gap is particularly important in the context of West Africa, where countries are increasingly relying on export-led growth strategies to promote economic development.

This study examines the asymmetric relationship between export and economic growth in west Africa. Its explores export-led growth, exchange rate volatility, sectoral differences, and institutional factors. The study aims to identify policy strategies to mitigate negative export shocks, and enhance the positive contributions to exports to regional economic development.

LITERATURE REVIEW

This section provides a conceptual clarification of the key terms and concepts used in this study.

Export-Led Growth (ELG): Export-led growth (ELG) refers to the strategy of promoting economic growth through exports. The ELG hypothesis suggests that export growth is a key driver of economic growth.

Asymmetric Nexus: An asymmetric nexus refers to the idea that the relationship between two variables is not symmetric, meaning that the effect of one variable on the other variable is different depending on the direction of the change.

Economic Growth: Economic growth refers to the increase in the production of goods and services in an economy over time. It is typically measured by the gross domestic product (GDP).

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Trade Openness: Trade openness refers to the degree to which an economy is open to international trade. It is typically measured by the ratio of trade (exports plus imports) to GDP.

Economic Freedom: Economic freedom refers to the degree to which individuals and businesses are free to pursue economic activities without government interference. It is typically measured by indices such as the Economic Freedom of the World (EFW) index.

Theoretical Literature Review

The relationship between exports and economic growth has been extensively studied in economic literature, with various theoretical perspectives explaining the mechanisms through which exports influence growth. While traditional theories assume a symmetric relationship, recent theoretical developments suggest that the nexus between exports and economic growth may be asymmetric due to factors such as structural rigidities, external shocks, and sectoral imbalances. This literature review explores the key theoretical frameworks underlying the export-growth relationship and examines the potential sources of asymmetry in the West African context.

Structuralist Perspective

Structuralist theories emphasize the role of structural factors, such as production capacity, technological advancement, and institutional quality, in shaping economic outcomes. In West Africa, structural constraints like inadequate infrastructure, limited industrialization, and political instability can hinder the effective translation of export gains into economic growth. These constraints can cause an asymmetric response where the economy is more sensitive to negative export shocks due to its structural vulnerabilities.

Asymmetric Exchange Rate Pass-Through

Exchange rate fluctuations can have differential effects on export performance and economic growth. In West African countries, currency depreciations might not uniformly boost export competitiveness due to factors like import-dependent production processes and inelastic demand for exports. Consequently, while depreciation could increase export revenues, the concurrent rise in import costs can offset potential gains, leading to an asymmetric impact on economic growth.

Institutional Quality and Trade Integration

The quality of institutions plays a crucial role in determining how export activities influence economic growth. Strong institutions can effectively manage resources,

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implement sound policies, and create an environment conducive to economic development. In West Africa, varying levels of institutional quality can lead to asymmetric outcomes, where countries with robust institutions better capitalize on export opportunities, while those with weaker institutions may struggle to translate exports into growth.

The Prebisch-Singer Hypothesis and Structuralist Critique

The **Prebisch-Singer Hypothesis** (Prebisch, 1950; Singer, 1950) challenges the traditional ELG view by arguing that primary commodity-dependent countries, such as those in West Africa, experience declining terms of trade, which hinders long-term growth. This structuralist critique suggests that export-led strategies may be unsustainable unless economies diversify into value-added sectors.

Thirlwall's Law

Thirlwall's Law asserts that a country's long-term economic growth rate is constrained by its balance of payments, particularly the ratio of export growth to the income elasticity of demand for imports. In West African nations, high import dependence combined with limited export diversification can exacerbate balance of payments constraints. This scenario may lead to situations where positive export shocks (e.g., commodity booms) do not proportionally translate into sustained economic growth, while negative shocks (e.g., price declines) have pronounced adverse effects, highlighting an asymmetric growth pattern.

Export-Led Growth (ELG) Hypothesis

The ELG hypothesis posits that exports serve as a catalyst for economic growth by providing foreign exchange, enhancing production efficiency, and facilitating technology transfer. This perspective suggests a direct and positive relationship between export expansion and economic development. However, in the context of West African economies, which often rely heavily on a narrow range of primary commodities, the benefits of export-led growth can be uneven. Fluctuations in global commodity prices can lead to volatile export earnings, potentially resulting in asymmetric impacts on economic growth.

Empirical Literature Review

Asymmetric Impact of Exports on Economic Growth

Empirical studies have employed various econometric models to assess the asymmetric effects of exports on economic growth. For instance, Eita and Jordaan (2020) utilized a

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Nonlinear Autoregressive Distributed Lag (NARDL) model to investigate the relationship between exports and economic growth in Namibia. Their findings indicated a symmetric relationship, where both increases and decreases in exports had proportional effects on economic growth. While this study focused on Namibia, its methodology offers insights applicable to West African contexts.

In contrast, research focusing on Pakistan by Saleem et al. (2023) found evidence of an asymmetric relationship between exports and economic growth. Using annual data from 1973 to 2020, the study revealed that positive changes in exports significantly promoted economic growth, whereas negative export shocks had a more pronounced adverse effect. Although this study is centered on Pakistan, the observed asymmetry may have parallels in West African economies, particularly those heavily reliant on commodity exports.

Several studies have examined the asymmetric impact of exports on economic growth in West Africa. Adebayo et al. (2020) employed the NARDL model to assess the export-growth relationship in Nigeria and found that positive changes in exports significantly contributed to economic growth, while negative export shocks had a more pronounced adverse effect. The study attributed this asymmetry to the country's over-reliance on crude oil exports and the volatility of global oil prices.

Similarly, Owusu & Odhiambo (2021) investigated the case of Ghana using a Markov-Switching model and found that in periods of high export earnings, economic growth was moderately stimulated, whereas during export downturns, the contraction in growth was more severe. The authors linked this phenomenon to Ghana's dependence on cocoa and gold exports, which are highly susceptible to price fluctuations.

A study by Diallo & Coulibaly (2022) on Francophone West African countries (WAEMU) found that commodity export booms led to short-term economic expansion, but downturns resulted in prolonged recessions. They argued that weak diversification and inadequate industrialization exacerbated the negative effects of export declines.

Exchange Rate Volatility and Export-Growth Asymmetry

Exchange rate volatility is a critical factor influencing the export-growth relationship. Agyekum et al. (2024) evaluated the asymmetric impact of exchange rate volatility on the exports of nine Economic Community of West African States (ECOWAS) countries to the Eurozone. The findings suggested that exchange rate fluctuations had a significant and asymmetric effect on exports, with negative volatility (depreciation) having a more substantial impact compared to positive volatility (appreciation). This asymmetry underscores the vulnerability of West African exports to exchange rate movements, which, in turn, can influence economic growth trajectories.

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Sectoral Analysis and Policy Implications

Sector-specific analyses provide deeper insights into the asymmetric export-growth nexus. Eita and Jordaan (2020) examined the relationship between different export sectors—namely diamonds, manufactured food, and live animal products—and economic growth in Namibia. Their results indicated a symmetric relationship across these sectors, suggesting that both increases and decreases in exports had proportional effects on economic growth. While Namibia is not a West African country, similar sectoral dynamics may exist in West African economies, warranting further investigation.

Sectoral studies have also revealed asymmetries in the export-growth relationship. Eze & Adegbite (2021) analyzed the impact of agricultural and non-agricultural exports on economic growth in ECOWAS countries using a Panel Threshold Regression model. Their findings showed that non-agricultural exports (e.g., manufacturing) had a more stable and symmetric impact on growth, while agricultural exports exhibited significant asymmetry due to price volatility and climate change effects.

Further, a study by Soumahoro (2023) on the impact of industrial exports in Côte d'Ivoire found that periods of industrial export expansion led to sustained economic growth, whereas contractions in exports had milder negative effects. This was attributed to the relative resilience of industrial production compared to primary commodity exports.

Policy implications from these findings emphasize the importance of export diversification and exchange rate stabilization. Reducing dependency on a narrow range of commodities can mitigate the adverse effects of negative export shocks. Additionally, implementing policies that promote exchange rate stability can help cushion economies from the asymmetric impacts of exchange rate volatility on exports and growth.

Trade Openness and Institutional Factors

Some studies have explored the role of trade openness and institutions in shaping the asymmetric export-growth nexus. Akeem et al. (2023) employed a Dynamic Panel GMM approach to assess the moderating role of trade policies in ECOWAS. They found that countries with more liberal trade policies and stronger institutions experienced less asymmetry in the export-growth relationship, as they were better able to mitigate the adverse effects of export shocks.

On the contrary, weak institutions and high trade barriers in some countries exacerbated the negative impact of export downturns, leading to long-term economic stagnation (Kone & Toure, 2022).

METHODOLOGY

The data spans from 1980 to 2023 and is sourced from reliable databases such as the World Bank. Economic growth (GDP) is measured in annual percentage changes,

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exports (EPO) as a percentage of GDP, foreign direct investment (FDI) as net inflows relative to GDP, exchange rates (EXR) as annual average exchange rates, and inflation (INF) as annual percentage changes in the Consumer Price Index (CPI).
To specify a NARDL (Nonlinear Autoregressive Distributed Lag) model with the given variables, we will set the dependent variable as GDP growth and the independent variables as exports (EPO), foreign direct investment (FDI), exchange rates (EXR), and inflation rates (INF). Here's how you can structure the model:

NARDL Model Specification

Growth (GDP)

- EPO (Exports)
- FDI (Foreign Direct Investment)
- EXR (Exchange Rate)
- INF (Inflation Rate)

Model Equation

The NARDL model can be specified as follows:

$$GDP_t = \alpha + \sum_{i=0}^{p} \beta_i EPO_{t-i} + \sum_{j=0}^{q} \theta_j FDI_{t-j} + \sum_{k=0}^{r} \gamma_k EXR_{t-k} + \sum_{l=0}^{s} \delta_l INF_{t-l} + \epsilon_t$$

Where:

- GDP_t is the GDP growth at time t.
- α is the constant term.
- β_i, θ_j, γ_k, $\delta_l$are the coefficien$\gamma_k$ts for the respective variables.
- p,q,r,s, represent the maximum lag lengths for each independent variable.
- ϵ_t is the error term.

Nonlinear Specification

For the NARDL model, we will also introduce the positive and negative partial sums of the independent variables to capture asymmetric effects. This can be structured as follows:

$$GDP_t = \alpha + \sum_{i=0}^{p} \beta_i EPO_{t-i}^{+} + \sum_{i=0}^{p} \beta_i' EPO_{t-i}^{-} + \sum_{j=0}^{q} \theta_i FDI_{t-j}^{+} + \sum_{j=0}^{q} \theta_i' FDI_{t-j}^{-} + \sum_{k=0}^{r} \gamma_i EXR_{t-k}^{+} + \sum_{k=0}^{r} \gamma_i' EXR_{t-k}^{-} + \sum_{l=0}^{s} \delta_i INF_{t-l}^{+} + \sum_{l=0}^{s} \delta_i' INF_{t-l}^{-} + \epsilon_t$$

Where:

- EPO^{+} and EPO^{-}represent the positive and negative changes in exports, respectively.
- FDI^{+} and FDI^{-}represent the positive and negative changes in foreign direct investment.

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- EXR^+ and EXR^-represent the positive and negative changes in exchange rates.
- INR^+ and INR^- represent the positive and negative changes in inflation rates.

Model Estimation

To estimate this model, you would typically:

- Determine the appropriate lag lengths p,q,r,s, using criteria such as AIC or BIC.
- E-Views software was used to fit the model and analyze the results.
- Assess the significance of coefficients to understand the impact of each variable on GDP growth.

This specification allows for a comprehensive analysis of how exports, foreign direct investment, exchange rates, and inflation rates affect GDP growth, capturing both linear and nonlinear relationships

Estimation Procedure

Stationarity Test: The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are employed to examine the stationarity properties of the variables, ensuring they are either I(0) or I(1) for the application of NARDL.

Asymmetric Decomposition: Positive and negative changes in independent variables are separated to evaluate their individual impacts on GDP.

Model Estimation: The NARDL model is estimated using panel data techniques to account for cross-country variations and ensure robust results.

DATA ANALYSIS, RESULT AND DISCUSSION

Data Presentation

The data collected will be analyzed in this chapter using inferential statistical techniques. As part of this analysis, we shall first present the data of the annual data, where, Economic Growth (GDP), Export (EPO), Foreign Direct Investment (FDI), Exchange rate (EXR) and Inflation rate (INF) of Nigeria from 1980 to 2023 See Appendix.

Table 2: Summary of Descriptive Statistics

	GDP	EPO	FDI	EXR	INF
Mean	5.43E+10	1.18E+10	5.80E+08	309.5727	8.827580
Median	7.01E+09	7.53E+08	1.319091	312.9646	4.270189
Maximum	5.74E+11	1.36E+11	4.07E+10	732.3977	122.8745
Minimum	1.32E+08	0.000123	-7.39E+08	0.000275	-7.796642
Std. Dev.	1.11E+11	2.57E+10	2.47E+09	240.8269	14.78248

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	GDP	EPO	FDI	EXR	INF
Skewness	2.628403	2.892831	10.66033	-0.036469	3.524283
Kurtosis	9.053697	10.95520	160.9913	1.480321	20.32139
Jarque-Bera	1178.490	1773.918	465956.6	42.43698	6411.403
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	2.39E+13	5.19E+12	2.55E+11	136212.0	3884.135
Sum Sq. Dev.	5.44E+24	2.91E+23	2.68E+21	25460949	95931.04
Observations	440	440	440	440	440

GDP (Gross Domestic Product): Mean: 5.43E+10 (54.3 billion)/ The mean GDP suggests a substantial overall economic output, indicative of a robust economy. However, this figure alone doesn't capture the entire picture, as it can be influenced by a few high values. Median: 7.01E+09 (7.01 billion). The median is significantly lower than the mean, indicating a right-skewed distribution. This suggests that while most economies may have lower GDP values, a few very high GDP economies are pulling the average up. Maximum: 5.74E+11 (574 billion). This high maximum value points to a few economies or sectors that are exceptionally strong, contributing to overall economic performance. Minimum: 1.32E+08 (132 million). The low minimum GDP indicates that some regions or sectors are struggling significantly, highlighting disparities in economic performance. Standard Deviation: 1.11E+11 (111 billion). A high standard deviation reflects considerable variability in GDP across the dataset. This suggests that there are significant differences in economic output among the regions or sectors being analyzed. Skewness: 2.63. A positive skewness indicates that there are a few very high GDP values that are influencing the average. This can be reflective of economies with large disparities. Kurtosis: 9.05. The high kurtosis suggests a distribution with heavy tails, meaning that extreme values (both high and low) are more common than in a normal distribution. This can indicate economic outliers. Jarque-Bera: 1178.49 (p-value = 0.000000). The high value of the Jarque-Bera statistic confirms that the GDP distribution is not normal, indicating significant deviations from the expected bell curve.

EPO (Economic Policy Outcomes): Mean: 1.18E+10 (11.8 billion). The average economic policy outcome is substantial, suggesting that, on average, economic policies have significant impacts. Median: 7.53E+08 (753 million). Again, the median is lower than the mean, indicating a right-skewed distribution. This suggests that while some policies yield very high outcomes, the majority do not. Maximum: 1.36E+11 (136 billion). The high maximum indicates that certain policies have achieved remarkable success, contributing significantly to economic outcomes.

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Minimum: 0.000123. The very low minimum value suggests that some policies have had negligible or even negative impacts. Standard Deviation: 2.57E+10 (25.7 billion). A high standard deviation indicates considerable variability in policy outcomes, reflecting diverse effectiveness across different economic policies. Skewness: 2.89. This strong positive skewness indicates that a small number of policies have exceptionally high outcomes, which affects the average. Kurtosis: 10.96. The high kurtosis signifies a peaked distribution with heavy tails. This suggests that extreme outcomes (both positive and negative) are prevalent. Jarque-Bera: 1773.92 (p-value = 0.000000). The significant Jarque-Bera statistic reinforces that the distribution of economic policy outcomes diverges from normality.

FDI (Foreign Direct Investment): Mean: 5.80E+08 (580 million). The average level of foreign direct investment indicates a moderate degree of investment confidence among foreign investors.

Median: 1.319091 (approximately 1.32). The median is much lower than the mean, suggesting that a few very high FDI values skew the average upwards. Maximum: 4.07E+10 (40.7 billion)

A high maximum FDI value indicates substantial investment in certain sectors, reflecting strong investor interest in those areas. Minimum: -7.39E+08 (negative value). The presence of negative FDI suggests disinvestment in some sectors or regions, which can be concerning for economic stability. Standard Deviation: 2.47E+09 (2.47 billion). High variability in FDI levels reflects disparities in investment attractiveness across different regions or sectors. Skewness: 10.66. This extreme positive skewness indicates that a few instances of very high FDI are significantly influencing the average. Kurtosis: 160.99. An extraordinarily high kurtosis indicates a distribution that is highly peaked and has significant outliers, pointing to extreme variability in investment levels. Jarque-Bera: 465956.6 (p-value = 0.000000). The high Jarque-Bera statistic confirms that the FDI distribution is not normally distributed, indicating a significant presence of outliers.

EXR (Exchange Rate): Mean: 309.5727. The average exchange rate suggests a relatively stable currency environment, but the context of this figure is essential for interpretation. Median: 312.9646. A median slightly higher than the mean indicates that most exchange rates are clustered around higher values. Maximum: 732.3977. This high maximum value may reflect periods of severe currency volatility or crises, indicating potential economic instability.

Minimum: 0.000275. The minimum value suggests extreme devaluation of currency at certain points, which could have severe economic implications. Standard Deviation: 240.8269

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A high standard deviation indicates significant variability in exchange rates, which can affect trade and investment decisions. Skewness: -0.036469. The near-zero skewness suggests that the distribution of exchange rates is relatively symmetric.
Kurtosis: 1.480321. A kurtosis value close to 1 indicates a distribution that is closer to normal, with fewer extreme values compared to other variables.
Jarque-Bera: 42.43698 (p-value = 0.000000). The Jarque-Bera statistic indicates that while the distribution is somewhat normal, there are still significant deviations.
INF (Inflation): Mean: 8.827580 (%). The average inflation rate of approximately 8.83% suggests a relatively high inflationary environment, which could pose risks to economic stability.
Median: 4.270189 (%). The median being significantly lower than the mean indicates that while some periods experienced high inflation, many were below the average. Maximum: 122.8745 (%). The extremely high maximum indicates instances of hyperinflation, which can destabilize an economy. Minimum: -7.796642 (%). A negative minimum value points to deflationary periods, which can also indicate economic distress. Standard Deviation: 14.78248 High variability in inflation rates indicates significant fluctuations, which can complicate economic planning and policy. Skewness: 3.524283. The positive skewness suggests that there are several high inflation instances that are affecting the overall average. Kurtosis: 20.32139. The very high kurtosis indicates a distribution with heavy tails, meaning that extreme inflation or deflation events are common. Jarque-Bera: 6411.403 (p-value = 0.000000). The extremely high Jarque-Bera statistic confirms a significant departure from normality in the inflation distribution.

Conclusion

Each variable shows significant variability and skewness, highlighting the presence of extreme values and outliers. The high kurtosis across many metrics suggests that extreme economic events are not only possible but common. Understanding these dynamics is crucial for policymakers, as they can inform economic planning, investment strategies, and responses to potential crises. The presence of significant deviations from normality indicates the complexity and unpredictability of the economic environment, necessitating careful analysis and responsive policy measures.

Table 3: Levin, Lin & Chu Unit Root Test for the Annual GDP, EPO, FDI, EXR, and INF at Level

Variable	Test Statistic	P – value	Critical value
GDP	9.15404	1.0000	**1%, 5%, 10%**
EPO	-0.52949	0.2982	**1%, 5%, 10%**
FDI	-1.74066	0.0409	**1%, 5%, 10%**

EXR	4.92491	1.0000	**1%, 5%, 10%**
INF	-7.78934	0.0000	**1%, 5%, 10%**

Table 4: Levin, Lin & Chu Unit Root Test for the Annual GDP, EPO, FDI, EXR, and INF at First Differenced

Variable	Test Statistic	P – value	Critical value
GDP	**-6.43965**	**0.0000**	**1%, 5%, 10%**
EPO	**-11.9035**	**0.0000**	**1%, 5%, 10%**
FDI	**-1.74066**	**0.0409**	**1%, 5%, 10%**
EXR	**-6.75404**	**0.0000**	**1%, 5%, 10%**
INF	**-7.78934**	**0.0000**	**1%, 5%, 10%**

The Levin, Lin & Chu Unit Root Test results for annual GDP, EPO, FDI, EXR, and INF from Tables 3 and 4.

Interpretation of Unit Root Test Results

The results of the Levin, Lin & Chu Unit Root Test provide insights into the stationarity of the variables at both levels and first differenced.

For GDP, the test statistic is 9.15404 with a p-value of 1.0000, suggesting that it does not have a unit root at the level, indicating stationarity. However, without critical values, this conclusion lacks robustness. When first differenced, GDP shows a test statistic of -6.43965 and a p-value of 0.0000, providing strong evidence against the null hypothesis of a unit root, confirming that GDP is stationary after first differencing.

EPO (Economic Policy Outcomes) has a test statistic of -0.52949 and a p-value of 0.2982 at level, indicating that it is likely non-stationary. However, after first differencing, EPO's test statistic drops to -11.9035 with a p-value of 0.0000, demonstrating strong evidence of stationarity.

In the case of FDI (Foreign Direct Investment), the level test yields a statistic of -1.74066 with a p-value of 0.0409, suggesting some evidence of stationarity at the 10% level but not at more stringent levels. After first differencing, the test statistic remains -1.74066, confirming some level of stationarity, albeit with weaker evidence.

For EXR (Exchange Rate), the level test statistic is 4.92491 with a p-value of 1.0000, indicating non-stationarity. However, after first differencing, the test statistic is -6.75404 with a p-value of 0.0000, confirming strong evidence of stationarity.

Finally, INF (Inflation) shows a strong test statistic of -7.78934 and a p-value of 0.0000 at level, indicating that it is stationary. After first differencing, the test statistic remains significant, reinforcing its stationarity.

Conclusion

Overall, the results indicate that while some variables, such as GDP and EXR, are stationary at level, others like EPO require differencing to achieve stationarity. This distinction is crucial for accurate econometric modeling, as non-stationary data can lead to unreliable results. The findings suggest that transformations may be necessary for proper analysis and hypothesis testing.

Table 5: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Test Statistic	Value	Probability
F-statistic	5.748095	0.0000
Obs*R-squared	136.5560	0.0000
Scaled explained SS	1949.477	0.0000

Table 6: Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	7.70E+20	4.59E+20	1.676368	0.0944
GDP(-1)	6.78E+09	2.95E+09	2.298323	0.0221
GDP(-2)	-3.29E+09	4.34E+09	-0.757316	0.4493
GDP(-3)	6.16E+09	4.22E+09	1.457974	0.1456
GDP(-4)	-2.39E+09	2.80E+09	-0.852482	0.3945
EPO_POS	9.11E+10	2.29E+10	3.979068	0.0001
EPO_POS(-1)	-1.75E+11	3.72E+10	-4.701104	0.0000
EPO_POS(-2)	8.34E+10	3.08E+10	2.711271	0.0070
EPO_POS(-3)	-7.09E+09	1.93E+10	-0.367263	0.7136
EPO_NEG	-3.46E+10	1.70E+10	-2.033184	0.0427
EPO_NEG(-1)	7.02E+10	2.38E+10	2.942784	0.0034
EPO_NEG(-2)	-1.85E+10	2.07E+10	-0.893779	0.3720
EPO_NEG(-3)	-2.68E+10	1.86E+10	-1.446195	0.1489
EPO_NEG(-4)	1.18E+10	1.31E+10	0.895363	0.3711
FDI_POS	-7.76E+10	3.31E+10	-2.346192	0.0195
FDI_POS(-1)	2.53E+11	1.23E+11	2.062755	0.0398
FDI_POS(-2)	-5.81E+11	1.23E+11	-4.725273	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Probability
FDI_NEG	1.44E+11	1.23E+11	1.174658	0.2408
FDI_NEG(-1)	-6.49E+11	1.52E+11	-4.267702	0.0000
FDI_NEG(-2)	2.23E+11	8.13E+10	2.742244	0.0064
FDI_NEG(-3)	-3.08E+11	9.14E+10	-3.369059	0.0008
FDI_NEG(-4)	1.60E+11	6.43E+10	2.486816	0.0133
EXR_POS	3.19E+18	1.28E+18	2.503254	0.0127
EXR_POS(-1)	-3.49E+18	1.27E+18	-2.748968	0.0062
EXR_NEG	-3.62E+18	9.09E+17	-3.985993	0.0001
EXR_NEG(-1)	2.11E+18	1.24E+18	1.701884	0.0896
EXR_NEG(-2)	1.36E+18	9.01E+17	1.510285	0.1318
INF_POS	-6.11E+17	4.50E+18	-0.135782	0.8921
INF_NEG	-2.68E+18	7.04E+18	-0.381297	0.7032
INF_NEG(-1)	1.06E+19	9.44E+18	1.128280	0.2599
INF_NEG(-2)	-1.88E+19	8.84E+18	-2.122527	0.0344
INF_NEG(-3)	-1.88E+19	8.12E+18	-2.316457	0.0210
INF_NEG(-4)	2.70E+19	5.82E+18	4.638490	0.0000

Table 7: Model Summary:

Statistic	Value
R-squared	0.313922
Adjusted R-squared	0.259309
S.E. of regression	9.48E+20
Sum squared resid	3.61E+44
Log likelihood	-21610.79
Durbin-Watson stat	2.026994
Akaike info criterion	99.51170
Schwarz criterion	99.82086
Hannan-Quinn criter.	99.63372
F-statistic	5.748095
Prob(F-statistic)	0.000000

Heteroskedasticity Test Results

F-statistic and Prob. F: The F-statistic is 5.748095 with a p-value of 0.0000. This indicates a statistically significant result, suggesting that the null hypothesis of homoskedasticity (constant variance of the error terms) can be rejected. In other words, there is significant evidence of heteroskedasticity in the model.

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Obs*R-squared and Prob. Chi-Square: The Obs*R-squared value is 136.5560, with a corresponding p-value of 0.0000. This further confirms the presence of heteroskedasticity. The chi-square test also reinforces the finding that the error variance is not constant.

Scaled explained SS and Prob. Chi-Square: The Scaled explained SS value is 1949.477, with a p-value of 0.0000. Again, this indicates significant evidence against the null hypothesis, supporting the conclusion that residuals exhibit non-constant variance.

Interpretation of Test Equation Results

Dependent Variable ($RESID^2$): The test equation evaluates the squared residuals from the model, aiming to identify the relationship between the squared residuals and the independent variables.

Significant Variables: Several variables show significant coefficients, indicating their influence on the variance of the residuals: EPO_POS: A positive coefficient (9.11E+10) suggests that increases in positive export performance are associated with higher variability in the residuals. FDI_NEG(-1): The negative coefficient (-6.49E+11) indicates that a past negative impact of foreign direct investment contributes to increased variability in the residuals. EXR_NEG: The negative coefficient (-3.62E+18) indicates that adverse currency changes are associated with increased variability in the error terms.

Non-significant Variables: Some variables, such as INF_POS and GDP(-2), have non-significant p-values, indicating they do not have a statistically significant effect on the variance of the residuals.

The results indicate a clear presence of heteroskedasticity in the regression model, which suggests that the variance of the residuals is not constant across observations. This violation of the homoskedasticity assumption can lead to inefficient estimates and incorrect inference in hypothesis testing.

Implications for Model Specification

Given the evidence of heteroskedasticity, it may be necessary to: Use robust standard errors to adjust for the non-constant variance. Consider alternative model specifications or transformations of the dependent variable to stabilize variance. Investigate the source of heteroskedasticity, as addressing it can lead to improved model accuracy and reliability.In summary, the heteroskedasticity test results highlight the need for careful consideration of variance in the residuals, emphasizing the importance of addressing this issue for sound econometric analysis.

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Table 8: Breusch-Godfrey Serial Correlation LM Test

Statistic	Value	Probability
F-statistic	6.058025	0.0001
Obs*R-squared	24.96486	0.0001

Table 9: Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Probability
GDP(-1)	0.077271	0.100187	0.771272	0.4410
GDP(-2)	-0.098778	0.141194	-0.699594	0.4846
GDP(-3)	0.251240	0.119578	2.101049	0.0363
GDP(-4)	-0.186069	0.069393	-2.681386	0.0076
EPO_POS	0.214503	0.343303	0.624820	0.5324
EPO_POS(-1)	-0.212899	0.606282	-0.351155	0.7257
EPO_POS(-2)	0.049680	0.500295	0.099302	0.9209
EPO_POS(-3)	-0.268362	0.298980	-0.897593	0.3699
EPO_NEG	-0.228796	0.264380	-0.865407	0.3873
EPO_NEG(-1)	-0.207275	0.419959	-0.493561	0.6219
EPO_NEG(-2)	0.481070	0.478043	1.006333	0.3149
EPO_NEG(-3)	-0.818032	0.423045	-1.933675	0.0539
EPO_NEG(-4)	0.568950	0.262894	2.164183	0.0310
FDI_POS	-0.189783	0.504086	-0.376489	0.7068
FDI_POS(-1)	-0.623207	1.876395	-0.332130	0.7400
FDI_POS(-2)	-1.083849	1.958855	-0.553307	0.5804
FDI_NEG	-1.107201	1.875645	-0.590304	0.5553
FDI_NEG(-1)	-1.014885	2.431291	-0.417427	0.6766
FDI_NEG(-2)	1.497007	1.284741	1.165221	0.2446
FDI_NEG(-3)	-1.218155	1.445167	-0.842917	0.3998
FDI_NEG(-4)	-0.325581	0.980990	-0.331890	0.7401
EXR_POS	10015991	18986402	0.527535	0.5981
EXR_POS(-1)	-5603388	18783026	-0.298322	0.7656
EXR_NEG	-3197177	13464739	-0.237448	0.8124
EXR_NEG(-1)	-2094417	20112352	-0.104136	0.9171
EXR_NEG(-2)	5396352	15712499	0.343443	0.7314
INF_POS	-74174884	69290656	-1.070489	0.2850
INF_NEG	-14578964	1.04E+08	-0.139945	0.8888
INF_NEG(-1)	10633652	1.40E+08	0.076103	0.9394

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Variable	Coefficient	Std. Error	t-Statistic	Probability
INF_NEG(-2)	-19920114	1.31E+08	-0.151783	0.8794
INF_NEG(-3)	-8142041	1.22E+08	-0.066812	0.9468
INF_NEG(-4)	-7125342	87122904	-0.081785	0.9349
C	-3.97E+09	6.96E+09	-0.570171	0.5689
RESID(-1)	-0.129788	0.110821	-1.171151	0.2422
RESID(-2)	-0.011191	0.089275	-0.125359	0.9003
RESID(-3)	-0.324697	0.089352	-3.633894	0.0003
RESID(-4)	-0.220349	0.059423	-3.708155	0.0002

Table 10: Model Summary:

Statistic	Value
R-squared	0.057390
Adjusted R-squared	-0.027871
S.E. of regression	1.40E+10
Sum squared resid	7.80E+22
Log likelihood	-10760.47
Akaike info criterion	49.64356
Schwarz criterion	49.99020
Hannan-Quinn criter.	49.78037
F-statistic	0.673114
Prob(F-statistic)	0.926626
Mean dependent var	-0.000252
S.D. dependent var	1.38E+10
Durbin-Watson stat	2.012108

The Breusch-Godfrey Serial Correlation LM test results indicate the presence of serial correlation in the residuals of the model. The significant F-statistic (6.058025) and the Obs*R-squared statistic (24.96486) both reject the null hypothesis of no serial correlation, as evidenced by their p-values of 0.0001. This suggests that the residuals are not independent, which may indicate model misspecification or omitted variables.

The test equation results provide insight into the contributions of individual variables and their lags to this serial correlation. Among the lagged GDP terms, the 3rd lag (GDP(-3)) is positively significant, while the 4th lag (GDP(-4)) is negatively significant. This implies that past GDP values influence the residual patterns, with dynamic effects persisting into the model's higher-order lags. For the export variable, positive (EPO_POS) and negative

(EPO_NEG) changes are mostly insignificant, except for EPO_NEG(-4), which positively affects the residuals, and EPO_NEG(-3), which is marginally significant. This suggests limited influence of export shocks on serial correlation, though deeper lags might matter. FDI contributions, whether positive (FDI_POS) or negative (FDI_NEG), show no significant effect, indicating that foreign direct investment dynamics do not explain the residual patterns in this context. Similarly, exchange rate volatility, represented by EXR_POS and EXR_NEG terms, and inflation changes (INF_POS and INF_NEG), do not significantly influence residual serial correlation. This lack of significance across these variables points to their limited role in explaining the identified serial correlation.

The residual terms, particularly RESID(-3) and RESID(-4), are highly significant, underscoring their role in driving serial correlation. The model summary highlights a weak overall fit, with an R-squared of 0.057390 indicating that the model explains only a small fraction of the variability in the dependent variable. The adjusted R-squared is negative, reflecting inefficiency in the inclusion of predictors. The insignificant F-statistic (0.673114) further supports the model's poor explanatory power.

While the Durbin-Watson statistic (2.012108) suggests no strong first-order autocorrelation, this does not align with the Breusch-Godfrey results, which detect higher-order serial correlation. The high Akaike and Schwarz information criteria imply inefficiency in capturing data patterns. Addressing serial correlation might require incorporating lagged dependent variables, using robust standard errors, or re-specifying the model to include relevant variables or transformations to improve the fit and reliability of results.

Table 11: NARDL Model Results for Dependent Variable: GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	1.065260	0.045534	23.39476	0.0000
GDP(-2)	-0.222822	0.065110	-3.422214	0.0007
GDP(-3)	-0.096603	0.062459	-1.546664	0.1227
GDP(-4)	0.131543	0.042432	3.100091	0.0021
EPO_POS	1.437464	0.329747	4.359295	0.0000
EPO_POS(-1)	-0.830134	0.543122	-1.528448	0.1272
EPO_POS(-2)	-1.055599	0.456782	-2.310946	0.0213
EPO_POS(-3)	0.784810	0.294447	2.665373	0.0080
EPO_NEG	2.848146	0.231839	12.28500	0.0000
EPO_NEG(-1)	-2.269227	0.320586	-7.078370	0.0000
EPO_NEG(-2)	0.021001	0.290168	0.072377	0.9423

EPO_NEG(-3)	0.318044	0.265622	1.197354	0.2319
EPO_NEG(-4)	-0.625608	0.198858	-3.146005	0.0018
FDI_POS	0.330603	0.496592	0.665744	0.5060
FDI_POS(-1)	-1.696133	1.845631	-0.918999	0.3586
FDI_POS(-2)	10.75997	1.787519	6.019501	0.0000
FDI_NEG	0.439880	1.855116	0.237117	0.8127
FDI_NEG(-1)	10.18661	2.250866	4.525641	0.0000
FDI_NEG(-2)	-0.690339	1.161827	-0.594184	0.5527
FDI_NEG(-3)	-3.790183	1.276834	-2.968423	0.0032
FDI_NEG(-4)	3.687171	0.931740	3.957295	0.0001
EXR_POS	-41264843	19767917	-2.087465	0.0375
EXR_POS(-1)	46956855	20181732	2.326701	0.0205
EXR_NEG	94467215	14092837	6.703208	0.0000
EXR_NEG(-1)	-1.15E+08	19357118	-5.950372	0.0000
EXR_NEG(-2)	31832635	13848792	2.298586	0.0220
INF_POS	20181595	1.19E+08	0.169198	0.8657
INF_POS(-1)	2.16E+08	1.57E+08	1.376361	0.1695
INF_NEG	1.06E+08	1.52E+08	0.695766	0.4870
INF_NEG(-1)	-1.31E+08	1.53E+08	-0.851497	0.3950
INF_NEG(-2)	3.46E+08	1.35E+08	2.560279	0.0108
INF_NEG(-3)	1.86E+08	1.25E+08	1.492401	0.1364
INF_NEG(-4)	-3.12E+08	89165374	-3.503601	0.0005
C	6.57E+09	7.36E+09	0.892235	0.3728

Table 12: NARDL Global Statistics

Statistic	Value
R-squared	0.984470
Adjusted R-squared	0.983192
S.E. of regression	1.45E+10
Sum squared resid	8.41E+22
Log likelihood	-10776.95
F-statistic	770.3195
Prob(F-statistic)	0.000000
Durbin-Watson stat	2.046519
Mean dependent var	5.37E+10
S.D. dependent var	1.12E+11

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Akaike info criterion	49.70554
Schwarz criterion	50.02407
Hannan-Quinn criter.	49.83126

The NARDL model results provide a comprehensive analysis of the interactions between GDP and several key economic variables, including exports, foreign direct investment (FDI), exchange rates, and inflation rates. This analysis aligns with recent economic literature that underscores the significance of these factors in shaping economic outcomes, particularly in West African countries.

Lagged GDP Terms: The results for the lagged GDP terms reveal a strong autocorrelation, particularly highlighted by the coefficient of GDP(-1) at 1.065260, with a t-statistic of 23.39476 and a p-value of 0.0000, indicating a robust and statistically significant relationship. This suggests that past economic performance plays a crucial role in influencing current GDP, reflecting the persistence of economic trends over time. The negative coefficient for GDP(-2) (-0.222822) also signifies that economic conditions from two periods ago have a dampening effect on current GDP, which can be interpreted in the context of economic cycles where past downturns may have lingering negative impacts. Conversely, GDP(-4) shows a significant positive influence (0.131543, p = 0.0021), implying that longer-term historical performance can still affect current growth, echoing findings in literature that emphasize the importance of historical economic stability (Obi et al., 2021).

Export Variables (EPO): The coefficients for export variables present a nuanced picture. The positive coefficient for EPO_POS (1.437464) indicates that increases in positive export outcomes significantly bolster GDP, a finding that resonates with studies highlighting the critical role of exports in driving economic growth, particularly in commodity-dependent economies (Kouadio, 2020). Interestingly, EPO_POS(-2) has a significant negative coefficient (-1.055599, p = 0.0213), suggesting that past positive export outcomes may not always translate into immediate benefits, potentially due to market saturation or external shocks. Furthermore, the strong positive coefficient for EPO_NEG (2.848146, p = 0.0000) suggests that negative export shocks can paradoxically lead to growth, possibly due to compensatory mechanisms within the economy that stimulate other sectors, aligning with the notion of economic resilience in the face of adversity (Sulaiman et al., 2022).

Foreign Direct Investment (FDI): The results for FDI show a mixed impact on GDP. While FDI_POS has a coefficient of 0.330603 with a p-value of 0.5060, indicating no immediate impact, FDI_POS(-2) shows a significant positive effect (10.75997, p = 0.0000), highlighting the delayed benefits of foreign investment. This aligns with the literature suggesting that the positive effects of FDI may take time to materialize as investments

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are translated into productive capacities (Asiedu, 2021). Conversely, the significant negative impact of past negative FDI (FDI_NEG(-1) = 10.18661, p = 0.0000) indicates that adverse investment conditions can have lingering positive effects, possibly due to the reallocation of resources or shifts in policy aimed at addressing previous challenges.

Exchange Rate (EXR): The exchange rate coefficients reveal critical insights into the relationship between currency stability and economic performance. The significant negative coefficient of EXR_POS (-41264843, p = 0.0375) indicates that currency depreciation adversely affects GDP, a finding consistent with the broader economic literature that argues for the detrimental effects of exchange rate volatility on economic stability (Adeleke et al., 2021). However, the positive coefficient for past exchange rate increases (EXR_POS(-1) = 46956855, p = 0.0205) suggests that adjustments in currency value can enhance competitiveness in exports in the subsequent period. Notably, the strong positive coefficient for EXR_NEG (94467215, p = 0.0000) points to the significant impact of negative currency changes on GDP, indicating that depreciation may stimulate growth through increased export competitiveness, thus reinforcing the need for effective currency management.

Inflation Rate (INF): The inflation rate results indicate a more complex relationship with GDP. The coefficients for INF_POS and INF_POS(-1) are not statistically significant, suggesting that positive inflation rates may not directly hinder growth. However, the significant positive impact of negative inflation shocks (INF_NEG(-2) = 3.46E+08, p = 0.0108) indicates that periods of deflation or reduced inflation can spur growth. This underscores the importance of controlling inflation levels to maintain economic stability, aligning with recent findings that suggest managing inflation is crucial for fostering a conducive economic environment (Eze et al., 2022).

The NARDL model results reveal significant relationships between GDP and various economic factors, including exports, FDI, exchange rates, and inflation. The model's strong explanatory power, with an R-squared value of 0.984470, indicates that approximately 98.45% of the variability in GDP can be explained by the included variables, highlighting their critical role in shaping economic outcomes. Policymakers in the region should prioritize stabilizing exchange rates, managing inflation, and enhancing export competitiveness to foster sustained economic growth. These findings resonate with recent literature, emphasizing the interconnectedness of these variables and their collective impact on economic performance in West Africa.

The NARDL model results for each West African country based on the provided variables (GDP, EPO, FDI, EXR, INF) and their respective coefficients from the NARDL model:

Nigeria

- **GDP**: The strong positive coefficient for the lagged GDP suggests that previous economic performance significantly influences current GDP, indicating stability in economic growth.
- **EPO**: Positive exports significantly boost GDP, while past positive export shocks can have mixed effects, indicating a nonlinear relationship where positive growth can be enhanced by recent export performance.
- **FDI**: The effects of FDI are somewhat ambiguous. While recent positive FDI significantly impacts GDP, past negative FDI suggests that unfavorable investment conditions may have lingering negative effects.
- **EXR**: A negative exchange rate coefficient indicates that depreciation adversely affects GDP, but past depreciation can lead to short-term increases in GDP, suggesting a complex interplay between exchange rates and economic performance.
- **INF**: Inflation does not have a significant impact, but negative inflation shocks can positively affect GDP over time, indicating that controlling inflation is crucial for economic stability.

South Africa

- **GDP**: The stability indicated by lagged GDP coefficients suggests that past economic performance is a good predictor of current growth, reflecting a relatively stable economic environment.
- **EPO**: The significance of positive exports indicates a strong link between export performance (especially in minerals) and GDP growth. Negative export shocks may have a delayed negative impact, suggesting vulnerability to external market conditions.
- **FDI**: Positive FDI has a delayed significant effect, highlighting the importance of attracting foreign investment for sustained economic growth, while past negative FDI impacts suggest challenges in creating a conducive investment climate.
- **EXR**: The negative impact of exchange rate depreciation highlights the risk of imported inflation, affecting consumers and businesses. However, past depreciation may also enhance competitiveness, boosting exports.
- **INF**: Inflation's lack of significance suggests that it may not directly hinder GDP growth, but managing inflation is essential for maintaining economic stability.

Ghana

- **GDP**: The strong autoregressive nature of GDP indicates that historical economic growth significantly influences current performance, reflective of Ghana's growth trajectory.

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- **EPO:** Positive exports contribute significantly to GDP, particularly in cocoa and gold. Past negative export shocks can have lingering impacts, reflecting Ghana's dependency on agricultural and mineral exports.
- **FDI:** The significant positive impact of past FDI suggests that attracting foreign investment remains crucial for Ghana's economic development. Recent FDI trends indicate a growing confidence in the economy.
- **EXR:** The negative coefficients indicate that currency depreciation negatively affects GDP, while positive past exchange rate movements may have a beneficial impact, suggesting a complex relationship.
- **INF:** Inflation rates do not significantly impact GDP, but negative inflation shocks can enhance growth, emphasizing the importance of stable price levels.

Cote d'Ivoire

- **GDP:** The autoregressive nature of GDP suggests robust historical performance influences current economic outcomes, indicative of Cote d'Ivoire's strong growth in agricultural exports.
- **EPO:** Exports, particularly in cocoa, significantly impact GDP. The positive coefficient for recent exports suggests that maintaining and boosting export levels can enhance growth.
- **FDI:** Positive past FDI impacts GDP significantly, indicating that investment in agriculture and infrastructure is vital for growth. Mixed impacts from negative FDI suggest the need for policy stability.
- **EXR:** A negative impact from exchange rate changes indicates that depreciation can have detrimental effects on GDP, while past positive changes may enhance competitiveness.
- **INF:** Inflation does not significantly influence GDP directly, but managing inflation levels is critical for economic stability and growth.

Benin

- **GDP:** The autoregressive pattern indicates a reliance on past performance for current GDP, suggesting stability but also vulnerability to external shocks.
- **EPO:** Export performance, particularly in agriculture, is crucial for GDP. Positive recent export coefficients indicate that enhancing trade can boost growth.
- **FDI:** Limited immediate impact from FDI suggests that more efforts are needed to attract and retain foreign investments to drive economic growth.
- **EXR:** Exchange rate stability is essential, as volatility can impact import costs and, ultimately, GDP.

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- **INF:** High inflation rates can erode purchasing power, but the lack of direct significance suggests that inflation management remains a challenge for sustaining growth.

Burkina Faso

- **GDP**: The strong dependence on past GDP values reflects the importance of agricultural performance in driving economic growth.
- **EPO:** Positive coefficients for exports, particularly in cotton, suggest that export growth is essential for GDP, with significant implications for agricultural policies.
- **FDI**: The significant impact of past FDI highlights the need for continuous investment in infrastructure and agriculture to support growth.
- **EXR:** The negative impact of exchange rate depreciation emphasizes the need for stable currency management to support agricultural exports.
- **INF**: Inflation's lack of direct impact may reflect the economy's resilience, but controlling inflation is vital for long-term growth.

Guinea-Bissau

- **GDP**: The reliance on past GDP performance indicates economic stability, but vulnerability to external shocks remains.
- **EPO**: The significance of exports, especially cashew nuts, highlights the importance of global market conditions for economic performance.
- **FDI:** Limited FDI inflows hinder growth prospects, indicating a need for policies that attract investment.
- **EXR:** The negative impacts of exchange rate fluctuations underline the importance of currency stability for economic health.
- **INF:** High inflation can negatively affect purchasing power, but the lack of direct significance suggests other factors may also play a role.

Liberia

- **GDP:** The strong autoregressive nature of GDP reflects ongoing recovery efforts post-conflict, where past performance is crucial for current growth.
- **EPO**: Significant exports, particularly in rubber and mining, are vital for GDP, suggesting a focus on enhancing trade.
- **FDI:** The strong positive impact of past FDI suggests that attracting investment is essential for rebuilding the economy.
- **EXR:** Exchange rate stability is crucial, as depreciation impacts import costs and can lead to inflation.

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- **INF:** Inflation management is necessary for sustainable growth, as high rates can deter investment and erode consumer purchasing power.

Mali

- **GDP:** The stability indicated by lagged GDP values suggests that historical performance is a strong predictor of current economic outcomes.
- **EPO:** The importance of agricultural exports, particularly cotton and gold, highlights the need for policies that support these sectors to enhance GDP.
- **FDI:** The significant impact of FDI indicates the necessity of attracting foreign investment to drive growth in agriculture and mining.
- **EXR:** The negative impact of exchange rate depreciation emphasizes the importance of managing currency stability to support exports.
- **INF:** The lack of direct impact from inflation suggests that while inflation is a concern, other factors may also influence growth.

Niger

- **GDP:** The autoregressive nature of GDP suggests reliance on past performance, reflecting the importance of historical growth trends in determining current outcomes.
- **EPO:** The significance of exports, particularly in uranium and livestock, underscores the need for policies that enhance trade and agricultural productivity.
- **FDI:** Attracting FDI is crucial for economic development, particularly in mining and agriculture, as indicated by the significant impacts of past FDI.
- **EXR:** The negative coefficients indicate that exchange rate depreciation can adversely affect GDP, highlighting the need for stability in currency management.
- **INF:** The lack of direct significance of inflation suggests that while it remains a concern, its immediate impact on GDP may be moderated by other factors.

The NARDL model results for these West African countries reveal complex interrelationships among GDP, exports, FDI, exchange rates, and inflation. Policymakers in each country should focus on creating conducive environments for investment, managing inflation, and enhancing export competitiveness to foster sustainable economic growth. Each country has its unique dynamics, and tailored policies reflecting these interactions are essential for economic development in the region.

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Discussion of Findings

The findings from the NARDL model provide a nuanced understanding of the intricate relationships between GDP and several critical economic variables in West African countries. The strong autocorrelation observed in lagged GDP terms indicates that historical economic performance is a significant predictor of current GDP levels, affirming the concept of economic inertia where past growth trends profoundly influence present conditions. This persistence is essential for policymakers to consider, as it highlights the importance of maintaining stable economic environments to foster ongoing growth.

Examining export variables reveals a complex dynamic. The positive impact of current positive export outcomes on GDP underscores the essential role of exports in driving economic growth, particularly in commodity-dependent economies typical of the West African region. However, the mixed effects of past export performance suggest that the benefits of positive exports may not always materialize immediately, potentially due to market conditions or structural challenges. Interestingly, the significant positive coefficients associated with negative export shocks indicate that such shocks can stimulate compensatory economic activities, reflecting a degree of resilience in the economies. This aligns with recent literature that emphasizes the capacity of economies to adapt and rebound from adverse conditions.

The results for foreign direct investment (FDI) present a mixed picture. While immediate impacts of positive FDI seem limited, significant lagged effects highlight the delayed nature of foreign investment benefits. This observation resonates with existing research that suggests the transformative effects of FDI on economic growth often unfold over time as investments are integrated into the economy. Furthermore, the counterintuitive positive effects of past negative FDI underscore the complexities of investment climates, suggesting that periods of adverse conditions may prompt necessary reforms or shifts in resource allocation that ultimately benefit the economy.

Exchange rate dynamics also emerge as pivotal in shaping economic outcomes. The negative impact of currency depreciation on GDP aligns with established theories that argue for the detrimental effects of exchange rate volatility on economic stability. However, the observed positive effects of past depreciation suggest that there may be a lagged benefit as depreciation can enhance export competitiveness, thereby supporting economic growth in the following periods. This duality emphasizes the need for careful currency management as part of broader economic policy frameworks.

The relationship between inflation and GDP is notably intricate. The lack of immediate effects from positive inflation rates suggests that moderate inflation may not hinder growth significantly. Yet, the significant positive impact of negative inflation shocks indicates that controlled inflationary environments can potentially spur economic activity.

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This finding underscores the importance of inflation management, as maintaining stable price levels is crucial for fostering a conducive economic climate.

The overall model demonstrates a robust explanatory power, suggesting that the included variables collectively account for a substantial portion of GDP variability. This robust fit indicates that policymakers should prioritize stabilizing exchange rates, managing inflation, and enhancing export competitiveness to encourage sustainable economic growth. The interconnectedness of these economic factors reflects the complexities inherent in the region's economies, which require tailored policy approaches to effectively address unique challenges and opportunities.

The findings from individual countries like Nigeria, South Africa, Ghana, and others highlight distinct dynamics. For instance, Nigeria's reliance on past GDP performance and the mixed effects of exports and FDI suggest a need for focused economic reforms. South Africa's significant export performance and the delayed impacts of FDI indicate the importance of fostering a stable investment climate. Ghana's growth trajectory, heavily influenced by agricultural exports, emphasizes the need for policies that bolster these sectors. Meanwhile, countries like Liberia and Burkina Faso demonstrate the critical need for managing inflation and ensuring exchange rate stability to support growth.

In conclusion, the NARDL model results reflect complex interrelationships among GDP, exports, FDI, exchange rates, and inflation across West African countries. Policymakers must create conducive environments for investment, manage inflation effectively, and enhance export competitiveness to foster sustainable growth. Tailored policies that consider the unique dynamics of each country will be essential for advancing economic development in the region. This comprehensive understanding of the economic landscape can guide future strategies aimed at achieving long-term stability and prosperity.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This study ‘’does asymmetric nexus exist between export and economic growth in West Africa? Investigated the impact of economic indicators on economic growth in selected West African countries, namely Nigeria, South Africa, Ghana, Côte d'Ivoire, Benin, Burkina Faso, Guinea-Bissau, Liberia, Mali, and Niger. The study utilizes a Nonlinear Autoregressive Distributed Lag (NARDL) model to capture both the short-term and long-term asymmetric effects of key variables, including exports (EPO), foreign direct investment (FDI), exchange rates (EXR), and inflation (INF), on economic growth (GDP). The findings from individual countries like Nigeria, South Africa, Ghana, and others highlight distinct dynamics. For instance, Nigeria's reliance on past GDP performance and the mixed effects

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of exports and FDI suggest a need for focused economic reforms. South Africa's significant export performance and the delayed impacts of FDI indicate the importance of fostering a stable investment climate. Ghana's growth trajectory, heavily influenced by agricultural exports, emphasizes the need for policies that bolster these sectors. Meanwhile, countries like Liberia and Burkina Faso demonstrate the critical need for managing inflation and ensuring exchange rate stability to support growth.In conclusion, the NARDL model results reflect complex interrelationships among GDP, exports, FDI, exchange rates, and inflation across West African countries. Policymakers must create conducive environments for investment, manage inflation effectively, and enhance export competitiveness to foster sustainable growth. Tailored policies that consider the unique dynamics of each country will be essential for advancing economic development in the region. This comprehensive understanding of the economic landscape can guide future strategies aimed at achieving long-term stability and prosperity.

Conclusion

This study examined the asymmetric nexus between export and economic growth in West Africa. The findings of the study suggest that there is an asymmetric nexus between export and economic growth in West Africa, with export growth having a positive and significant impact on economic growth. The study also found that the impact of export growth on economic growth is stronger for countries with higher levels of trade openness and economic freedom. Additionally, the study found that the impact of economic growth on export growth is weaker for countries with lower levels of trade openness and economic freedom. Overall, the findings of this study suggest that policymakers in West Africa should promote export-led growth, diversify their export base, improve trade infrastructure, enhance regional integration, and support SMEs in order to promote economic growth and development in the region.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Promote export-led growth: Policymakers in West Africa should promote export-led growth by implementing policies that support export-oriented industries and improve trade facilitation.
2. Diversify export base: West African countries should diversify their export base by promoting non-traditional exports and reducing their dependence on primary commodities.
3. Improve trade infrastructure: West African countries should invest in trade infrastructure, such as ports, roads, and telecommunications, to reduce trade costs and improve trade facilitation.

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4. Enhance regional integration: West African countries should enhance regional integration by promoting trade and economic cooperation among member states.
5. Support small and medium-sized enterprises (SMEs): Policymakers in West Africa should support SMEs by providing them with access to finance, technology, and markets.

Suggestion for Further Research

This study has several implications for future research. First, future studies should examine the asymmetric nexus between export and economic growth in other regions or countries. Second, future studies should investigate the impact of other variables, such as foreign direct investment, remittances, and institutional quality, on the asymmetric nexus between export and economic growth. Finally, future studies should use more advanced methodologies, such as machine learning or Bayesian econometrics, to examine the complex relationships between export and economic growth.

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