

GROSS DOMESTIC PRODUCT (GDP) AND ITS GROWTH RATE ON SELECTED AFRICAN COUNTRIES: A PANEL REGRESSION APPROACH

¹RASAKI YINKA AKINBO and ²ABAYOMI AYODELE AKOMOLAFE

¹Department of Mathematics and Statistics, Federal Polytechnic, Ilaro, Ogun State
rasaki.akinbo@federalpolyilaro.edu.ng

²Department of Statistics, Federal University of Technology, Akure, Nigeria.
akomolafeayotade@gmail.com

ABSTRACT: The economic growth of African countries is influenced by a range of factors, including labor, Foreign Direct Investment (FDI), exchange rate fluctuations, and inflation. This study focused on African countries and specifically on Nigeria, Côte d'Ivoire, and Senegal to explore how these variables affect GDP growth rates. The aim of this study is to investigate the impact of labor, FDI, exchange rate, and the selected countries using a panel regression approach. A panel regression analysis was conducted using data from the three selected West African countries between 1995 to 2024. The model includes labor, FDI, exchange rate, and inflation as independent variables, with country-specific effects accounted for through a random effects model. The results reveal that in Nigeria, labor significantly negatively impacts GDP growth, suggesting inefficiencies in the labor market. FDI and exchange rate fluctuations do not have significant effects. In Côte d'Ivoire, FDI significantly enhances GDP growth, while the exchange rate has a significant negative impact. In Senegal, none of the examined variables labor, FDI, exchange rate, or inflation shows a significant impact on GDP growth, indicating the presence of other influencing factors. The study highlights the varying effects of labor, FDI, exchange rate, and inflation on GDP growth across Nigeria, Côte d'Ivoire, and Senegal. The significant role of FDI in Côte d'Ivoire underscores the importance of foreign investment in economic growth, while the negative impact of labor in Nigeria points to labor market inefficiencies. These findings provide valuable insights for policymakers to tailor strategies that address specific economic challenges and leverage opportunities for growth in these countries.

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Keywords: Labor; Foreign Direct Investment; Exchange Rate Fluctuations and Inflation.

1.0 INTRODUCTION

1.1 Background of the Study

Nigeria's economy has experienced major changes and difficulties throughout the years (Aliyu & Amadu, 2017). Nigeria, with the largest population in Africa and one of the greatest economies there (Abubakar et al., 2022), depends on its economy not just for its own prosperity but also for regional and global economic dynamics. Foreign Direct Investment (FDI), inflation rate and exchange rate changes have been identified as a crucial determinant of Nigeria's economic trajectory, which has been affected by a number of important factors. According to Aurangzeb and Stengos (2014), foreign direct investment (FDI) is a vital source of capital, technology, and knowledge that has been crucial in promoting economic development in the country. In addition to increasing investment in important areas, the FDI flow into Nigeria has facilitated the creation of jobs, the transfer of knowledge, and the growth of the country's industrial and infrastructure capacities (Okonkwo et al., 2015). But FDI's impact on Nigeria's economic expansion is linked to the dynamics of changes in currency rates (Kenny, 2019). Nigeria's currency, the Naira, fluctuates in value in respect to other currencies, and these fluctuations can have a significant effect on how competitive Nigerian goods and services are on the international market.

A declining value of the Naira might increase Nigeria's appeal as a place to invest, attracting foreign direct investment (FDI). On the other hand, it can also make import prices and inflation worse, which would be bad for the home economy. To fully appreciate the complexities of Nigeria's economic development, one must have a thorough understanding of the complex links and interactions that exist between various variables. Notably, there is a dynamic interaction rather than a one-way relationship between FDI and exchange rate swings (Syarifuddin, 2022). Infrastructure, general investment climate, and regulatory framework all affect how much foreign direct investment (FDI) boosts the country's economy. Furthermore, Nigeria's reliance on oil exports and the developments in the country's inflation rate have a big impact on the country's overall economic circumstances. With oil exports accounting for a considerable amount of government revenue, Nigeria's economy continues to be firmly based on this sector. Nigeria's production levels and the volatility of the world oil market are key factors in determining the country's financial situation.

Conversely, patterns in inflation rates reveal the stability and purchasing power of the populace (Floyd, 2021). Elevated and fluctuating inflation rates have the potential to diminish consumers' purchasing power, impacting enterprises and capital investments (Floyd, 2021). Nigeria's path to long-term economic growth and stability is complex, characterized by difficulties, changes in policy, and outside influences.

Nigeria has long been a beacon for international investors looking to take advantage of its enormous economic potential because of its wide and varied variety of natural resources as well as its ideal geographic location. Rich natural resources, such as vast oil reserves, fertile land, mineral deposits, and a sizable labor population, contribute to the nation's attraction (Anthony, 2022). Global entrepreneurs, businesses, and institutional investors have taken notice of the potential presented by these variables, which give a solid foundation for investment across a range of sectors. Nigeria's economic growth has been significantly accelerated by foreign direct investment (FDI). Foreign capital inflows have played a significant role in boosting the country's productivity and economic activity.

Energy, manufacturing, and services are among the important economic sectors in Nigeria where foreign direct investment (FDI) has made inroads (Oyegoke & Aras, 2021). Nigeria's position as one of Africa's leading producers of gas and oil has drawn substantial foreign direct investment (FDI) into the energy industry in particular (Kimiagari et al., 2023). Foreign investments are therefore a major factor in Nigeria's GDP growth since they have raised oil output, enhanced infrastructure, and expanded capacity (Abdulkarim, 2023).

Concurrently, the mechanics of currency rate swings have significantly influenced Nigeria's trade balance and overall economic output. Wide-ranging effects may result from fluctuations in the value of Nigeria's currency, the Naira, relative to other currencies. A depreciating Naira, for instance, can make Nigerian exports more competitively priced in international markets, boosting the export of goods and services. However, it can also lead to increased import costs, affecting the overall balance of trade. As such, the exchange rate is not merely an economic indicator but a critical determinant of the nation's economic competitiveness on the global stage. It takes careful balance to handle these variations in the exchange rate for Nigeria. The monetary and fiscal policies of the government, along with other external economic factors, are significant determinants of the value of the Naira. Economists, investors, and politicians all need to comprehend these processes and how they affect the overall state of the economy. When governments in Africa started to express interest in multifaceted trade agreements in the late 1980s, their skepticism about the advantages of free trade in the late 1970s was dispelled (Yang & Gupta, 2008).

Emerging markets like the international gross domestic products (GDPs) of China and India increased from 3.6% and 4.14 percent in 1990 to 7.62 percent and 18.33 percent in 2017. (IMF, 2018). Economists, however, assert that there are winners and losers in trade. As a result, economies experiencing trade losses contribute less to the global GDP. Nyasha & Odhiambo (2022) claim that while the theory underlying the expanding effect of trade openness on economic development is hazy, the influence of trade openness on economic growth is extensively contested. Trade increased significantly as a percentage of GDP in Africa from 38 to 48 percent between 1988–1989 and 1999–2000. Despite this increase, the region's share of world trade has declined because of its exports' sluggish development relative to the global economy. The continent of Africa has been marginalized in international trade partly because of its export structure; its main exports have been primary goods, mainly agricultural produce, which are not competitive on the global market because of low productivity and unfavorable exchange rates (Bjornlund et al., 2022). In addition, the cost of these commodities is still declining in comparison to manufactured goods, and their price volatility on the international market is significant (United Nations, 2001).

Inflation, another critical macroeconomic indicator, affects household consumption, business investment decisions, and general economic stability. In Nigeria, inflation trends are often influenced by currency depreciation, volatile commodity prices, and supply chain constraints. Understanding the interplay among FDI, inflation, and exchange rate fluctuations is essential for formulating sound economic policies that promote stability and growth. To deepen the analysis and place Nigeria's experience within a broader regional context, this study includes Côte d'Ivoire and Senegal as comparative case studies. Côte d'Ivoire is one of the leading economies in Francophone West Africa, known for its strong post-conflict recovery and export-driven growth. Senegal has recorded steady economic progress through policy reforms, infrastructure investments, and an emerging oil and gas industry. Comparing these economies with Nigeria provides a more robust understanding of how similar macroeconomic factors affect growth under different economic structures and policy environments.

This study employs panel regression analysis to examine the influence of foreign direct investment, inflation rate, and exchange rate on the economic growth of Nigeria, Côte d'Ivoire, and Senegal over a selected time period. The panel data approach allows for capturing both cross-country and time-series variations, offering deeper insights into the dynamics of macroeconomic performance in West Africa. The findings will not only help policymakers in designing targeted economic strategies but will also serve as a valuable reference for regional economic planning and investment decisions.

2.0 LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Economic growth

Economic growth is defined as increasing or enhancing the consumer prices or market value of an economy's goods and services. Growth has traditionally been expressed by statisticians as a percentage increase in real GDP, or gross domestic output. Growth is often measured in real terms, or inflation-adjusted terms, to prevent the distorting effect of inflation on the pricing of goods produced. Economic growth is measured through the use of national income accounting. The annual percentage change in the gross domestic product (GDP) encompasses both the advantages and disadvantages of economic expansion. GDP to population ratios (per-capita income) are widely used to compare the economic growth rates of different countries. Economists define intensive growth as an increase in international trade caused by increased efficiency (increased labor productivity, physical capital productivity, energy productivity, or material productivity). GDP growth driven only by growth in the number of inputs available for utilization (for example, increasing population or new territory) is classified as extensive growth.

2.1.2 Inflation Rate

One important macroeconomic statistic is the inflation rate, which expresses the overall growth in prices within an economy. The literature has done a thorough analysis of its impact on the relationship between trade openness and economic growth. Elevated inflation rates have the potential to reduce buying power and impede economic expansion. One important macroeconomic indicator that significantly influences how a nation's economy is shaped is its inflation rate. It is a measure of how quickly the overall level of prices in an economy increases for products and services, which lowers the buying power of a country's currency.

2.1.3 Gross Domestic Product (GDP)

Gross Domestic Product (GDP) serves as a comprehensive measure of a nation's economic output. The literature explores how GDP growth interacts with trade openness, with many studies suggesting that increased trade can stimulate economic growth by providing access to larger markets and fostering specialization. Gross Domestic Product (GDP) serves as a fundamental measure of a nation's economic performance and output. It quantifies the total value of goods and services produced within a country's borders within a specified period, typically annually or quarterly. In the context of the relationship between trade openness and economic growth, GDP plays a crucial role in several ways. The literature on international economics and economic growth frequently explores how increased trade openness can impact a country's GDP growth rate. Trade openness, often characterized by increased exports and imports, can contribute positively to GDP growth through various channels. Trade openness allows access to larger international markets, potentially leading to increased exports of domestically produced goods and services. Trade promotes specialization, enabling countries to allocate resources more efficiently. This can result in increased productivity and higher GDP growth as countries focus on producing goods and services, in which they have a comparative advantage. Through trade and foreign direct investment (FDI), technology and knowledge can flow across borders.

2.1.4 Exchange Rate

Exchange rates, which determine the relative value of one currency against another, can influence a country's trade balance and export competitiveness. Exchange rates, which determine the relative value of one currency against another, are pivotal in understanding how trade openness influences economic growth. The dynamics of exchange rates can significantly affect a country's trade balance, export competitiveness, and overall economic performance. The exchange rate is a fundamental determinant of a country's trade openness. The relative strength or weakness of a nation's currency can impact on the volume and composition of international trade. A depreciated domestic currency can enhance the competitiveness of a country's exports by making them relatively cheaper for foreign buyers. Countries adopting fixed exchange rate regimes may benefit from exchange rate stability, which can provide predictability for businesses engaged in international trade. However, maintaining a fixed exchange rate can also entail constraints on monetary policy and may require fiscal discipline.

2.1.5 Foreign Direct Investment (FDI)

Foreign direct investment (FDI) involves the investment by one country's residents or businesses in another country. Foreign Direct Investment (FDI) is a crucial element in the nexus of trade openness and economic growth. FDI involves investments made by individuals, businesses, or governments of one country in productive assets located in another country. It plays a multifaceted role in shaping the economic landscape of nations and has direct implications for the relationship between trade openness and economic growth. FDI and trade openness are interconnected aspects of economic globalization. FDI can facilitate trade by establishing local production facilities or subsidiaries, enhancing a country's access to global markets. FDI can lead to the integration of domestic industries into global supply chains. This integration enhances the competitiveness of domestic firms, potentially increasing their participation in international trade. The presence of FDI within an economy can have a direct impact on economic growth.

2.2 Empirical Review

Various studies have used different variables and approaches in finding the determinants of GDP growth. Nketiah et al. (2020) estimated Foreign Direct Investment on Trade Openness on Economic Growth: Evidence from Ghana from 1975 to 2017. The analysis was based on time series which indicated that trade openness is a main factor affecting Economic growth. The study also found inflation had no significant impact on economic growth. Adhikary (2010) used FDI, Trade openness and capital formation with the co-integration analysis to assess economic growth In Bangladesh. He established that FDI and Capital

formation can influence GDP growth rate. Similarly, Seyoum et al. (2015) used FDI and Trade Openness panel data from 25 sub-Saharan African countries to examine its impact on economic growth (GDP growth) and found a bi-directional causal relationship.

Grossman and Helpman (1994) outlined that an economy stands to benefit from trade openness; technological transfer and productivity improvement on one side, and a boost for economic growth through improvement in domestic investment on the other side. From the empirical point, Fosu (1992) in investigating export and economic growth correlation among African economies, argues that export increase improved economic growth in African countries based on an augmented production function.

Bronfenbrenner and Holzman (1963) explored the connections among Swedish producer prices, import prices, and inflation. They concluded that import prices do not significantly impact inflation in Sweden. In contrast, McCarthy (2007) focused on the United States, revealing a notable relationship between import prices and inflation. McCarthy employed a VAR model to trace pass-through effects from exchange rate fluctuations to different stages of the distribution chain. While exchange rate shocks had a modest impact on domestic inflation, import price shocks exhibited a more substantial effect according to the study's impulse-response functions. However, variance decompositions suggested a mild role for exchange rate and import price shocks in explaining inflation volatility.

Bodea (2010) highlighted the significance of exchange rates for monetary policy, especially when the exchange rate pass-through is high. This factor directly and indirectly affects the real and financial sectors. Fagbemi and Ajibike (2019) examined the UK context and found that extreme positions, either emphasizing or dismissing the pass-through effect, lacked empirical justification. Moreover, Bibi et al. (2014) conducted a study investigating the impact of trade openness, inflation, imports and exports, real exchange rate, and foreign direct investment on economic growth in Pakistan. Utilizing time series data from 1980 to 2011, their results unveiled a long-run relationship among the examined variables. Notably, the findings indicated a negative association 16 between trade openness and economic growth, while emphasizing foreign direct investment as a crucial element enhancing economic growth.

In the study by Gyamfi et al. (2019), the examination of changes in exchange rates on output and inflation in the West Africa Monetary Zone (WAMZ) economies was conducted using vector autoregressive and variance decompositions techniques. The results highlighted a significant impact of exchange rates on inflation in all member states. Specifically, a negative relationship between real exchange rates and real GDP growth was identified for Sierra Leone, implying that depreciation of real exchange rates in these countries could lead to output growth. However, in Gambia, Ghana, Guinea, and Nigeria, the impact of exchange rates on output was positive but weak, attributed to supply-side factors.

Amato et al. (2005) emphasized in small open economies, especially emerging markets, that capital inflows can drive the expansion of domestic credit, making these economies susceptible to a sudden withdrawal of foreign capital.

Regarding Nigeria, Bawa et al. (2016) utilized bounds tests to the cointegration approach to examine the dynamics of the inflationary process. Their empirical study identified past inflation and average rainfall as the main determinants of the inflationary process in Nigeria. The study also provided strong evidence in support of the impact of money supply in the inflation process. Scholars argued that the effectiveness of demand is primarily based on the willingness and ability of an individual to buy a good or service.

Additionally, Akinwolere Bukola (2021) conducted a study on the influence of exchange rate volatility on macroeconomic variables in Nigeria, employing the ordinary least square method of analysis. The findings indicated a positive impact on gross domestic product, foreign direct investment, and trade openness. However, there was a negative influence on the inflationary rate in the country. Onuoha and Perpetua (2014) established a positive correlation between exchange rates and inflation, suggesting that the depreciation of the exchange rate triggers inflation. Conversely, a negative relationship was identified between exchange rates and economic growth. 18 Regarding inflation and economic growth, moderate inflation was found to enhance investments and should be tolerated, although it could be detrimental when it is high.

Fagbemi and Ajibike (2019), using quarterly data spanning 20 years (1995-2015) with the Johansen approach to cointegration and a vector error correction methodology, found a higher impact of pass-through in imports compared to inflation. Similarly, Tochukwu et al. (2016) investigated the impact of inflation on real exchange rate volatility in Nigeria, analyzing quarterly data from the first quarter of 1970 to the last quarter of 2014. They detected a unidirectional causality running from inflation to real exchange rate volatility, and causality was also found from the entire sample variable to imported inflation.

3.0 METHODOLOGY

3.1 Design

This study employs a quantitative research design, specifically utilizing a panel data regression model to investigate the determinants of GDP growth rate in African countries. The choice of panel data is motivated by its ability to account for both cross-sectional and time-series variations, thus providing a more comprehensive analysis of the economic growth dynamics across different countries and over time. The study focuses on West African countries, with Nigeria, Cote d'Ivoire, and Senegal

serving as case studies to examine the specific impact of foreign direct investment (FDI), inflation rate, and exchange rate on economic growth. The statistical software used in the study is STATA version 14.

3.2 Source of data

The data set used in this study is secondary panel data obtained from the world bank website, <https://data.worldbank.org/> collected between the period of 1995 to 2024. Data on GDP, Foreign Direct Investment (FDI), exchange rate, and inflation rate was collected.

3.3 Variable Description and Measurement

In this section, we define and describe the key variables used in the analysis of the determinants of GDP growth rate in African countries. This includes both the dependent variable (GDP growth rate) and the independent variables (foreign direct investment, inflation rate, and exchange rate), as well as any control variables that may be included to ensure a robust analysis.

3.3.1 Dependent Variable

GDP Growth Rate (GDPG): The GDP growth rate is the dependent variable in this study. It represents the annual percentage growth rate of Gross Domestic Product (GDP) at market prices based on constant local currency. The data for GDP growth rate is sourced from the World Bank's World Development Indicators.

3.3.2 Independent Variables

- i Foreign Direct Investment (FDI): FDI is expressed as a percentage of GDP and is expected to have a positive impact on economic growth by providing capital, technology, and management expertise.
- ii Inflation Rate (INF): It is measured as the annual percentage change in the consumer price index (CPI), which reflects the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals.
- iii Exchange Rate (EXC): The exchange rate is measured as the annual average of the official exchange rate determined by national authorities or the rate determined in the legally sanctioned exchange market.

iv Labour ratio: The Labour Ratio refers to the proportion of the working-age population actively engaged in the labor market relative to the total population or to another economic indicator, such as GDP. It is a measure used to assess the level of labor force participation in an economy, reflecting the extent to which available labor resources are utilized in productive activities.

3.4 Method of Data Analysis

3.4.1 Panel Regression

Panel regression is a statistical method that combines cross-sectional and time-series data, allowing for the examination of multiple countries over several periods. The general form of a panel regression model is expressed as:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it} \quad (1)$$

where

Y_{it} represents the dependent variable (GDP growth rate) for country i at time t .

α is the intercept,

β is the coefficient vector,

X_{it} represents the independent variables (FDI, inflation rate, exchange rate), and

μ_{it} is the error term.

3.4.2 Fixed Effect Model

The Fixed Effect Model (FEM) is used to control for time-invariant characteristics of the countries that could bias the results. This model assumes that individual country characteristics are unique and should not be correlated with other countries' characteristics. The equation for the fixed effect model is:

$$Y_{it} = \alpha_i + \beta X_{it} + \mu_{it} \quad (2)$$

where α_i represents the individual-specific effect.

3.4.3 Random Effect Model

The Random Effect Model (REM) assumes that the individual-specific effects are random and uncorrelated with the independent variables. This model is efficient when the unobserved individual effects are assumed to be uncorrelated with the explanatory variables. The equation for the random effect model is:

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it} + \epsilon_i \quad (3)$$

where ϵ_i is the between-entity error term.

3.4.4 Hausman Test

The Hausman Test is used to determine whether the fixed effect or random effect model is more appropriate for the data. The null hypothesis of the Hausman test states that the preferred model has random effects. The test statistic is given by:

$$H = (\beta_{RE} - \beta_{FE})' [var(\beta_{FE}) - var(\beta_{RE})] (\beta_{RE} - \beta_{FE}) \quad (4)$$

where β_{RE} and β_{FE} are the coefficients from the random and fixed effect models, respectively.

3.5 Pre-Regression Analysis

3.5.1 Heteroskedasticity Test

Heteroskedasticity occurs when the variance of the error terms is not constant across observations, which can lead to inefficient estimates. To test for heteroskedasticity, we use the Breusch-Pagan test. The Breusch-Pagan test is specifically designed to detect heteroskedasticity in a regression model. The null hypothesis is that there is no heteroskedasticity.

3.5.2 Test for Serial Correlation

Serial correlation, or autocorrelation, occurs when the residuals are correlated across time, which violates the assumption of independence of errors in regression analysis. To test for serial correlation, the Durbin-Watson test is commonly used. The test statistic is given by:

$$d = 2(1 - \rho) \quad (5)$$

where ρ is the estimated correlation between residuals. The value of d ranges from 0 to 4, with a value around 2 indicating no serial correlation. Values below 2 suggest positive serial correlation, while values above 2 indicate negative serial correlation.

3.6 Econometric Model Specification

The econometric model specification for analyzing the determinants of GDP growth rate in African countries utilizes a panel regression framework. The model incorporates key macroeconomic variables that are hypothesized to influence economic growth, specifically focusing on foreign direct investment (FDI), inflation rate, and exchange rate. The general form of the econometric model is expressed as follows:

$$GDPG_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 INF_{it} + \beta_3 EXC_{it} + \beta_4 LBF_{it} + \mu_{it} \quad (6)$$

where:

$GDPG_{it}$ represents the GDP growth rate of country i at time t .

β_0 is the intercept term.

$\beta_1, \beta_{2,3}$ are the coefficients for the independent variables.

FDI_{it} is the foreign direct investment as a percentage of GDP for country i at time t .

INF_{it} is the inflation rate for country i at time t .

EXC_{it} is the exchange rate for country i at time t .

LBF_{it} is the labour force for the country i at time t .

μ_{it} is the error term.

To control for unobserved heterogeneity, both fixed effects and random effects models will be considered. The fixed effects model captures country-specific effects that do not vary over time, while the random effects model assumes that these effects are random and uncorrelated with the independent variables.

The choice between the fixed effects and random effects models will be determined using the Hausman test. This test assesses whether the unique errors (country-specific effects) are correlated with the regressors. If the null hypothesis of no correlation is rejected, the fixed effects model is preferred.

4.0 ANALYSIS, RESULTS AND DISCUSSION

4.1 Descriptive Analysis

Table 1 presents the summary statistics for the variables included in the study, which examines the determinants of GDP growth rate in African countries using a panel regression approach. The Labour variable, which represents the labor force participation rate, has a mean value of 42.981 with a standard deviation of 5.221. This suggests that, on average, the labor force participation rate across the African countries in the sample is around 42.98%. The minimum value of 30.018 indicates that the lowest labor force participation rate observed in the sample is 30.02%, while the maximum value of 50.663 indicates that the highest observed rate is 50.66%. The relatively low standard deviation suggests that labor force participation rates are fairly consistent across the countries analyzed. Foreign Direct Investment (FDI) has a mean of 5.501 and a much higher standard deviation of 13.744, indicating significant variability in FDI inflows across the African countries in the sample. The minimum FDI value of -11.199 suggests that some countries experienced net outflows of FDI, while the maximum value of 161.824 indicates substantial FDI inflows in certain countries. The wide range of FDI values highlights the disparity in the attractiveness of different African economies to foreign investors during the period under review.

The Exchange Rate variable exhibits a mean of 652.308, with a notably high standard deviation of 1323.236. This considerable variation reflects the diverse exchange rate regimes and economic conditions across the African countries studied. The minimum exchange rate of 9.544 and the maximum rate of 9565.082 further underscore the wide differences in currency values relative to a benchmark, like the US dollar. This suggests that while some countries maintain relatively stable exchange rates, others have experienced significant currency depreciation or volatility. Inflation, measured as the annual percentage change in the Consumer Price Index (CPI), has a mean of 5.294 with a standard deviation of 7.464. The minimum inflation rate of -3.503 indicates that some countries experienced deflation, while the maximum inflation rate of 72.836 points to hyperinflation in certain cases. The high standard deviation reveals considerable variation in inflation rates across the countries, reflecting differences in monetary policies, economic stability, and external shocks.

Finally, the dependent variable, GDP growth rate, has a mean value of 4.013 with a standard deviation of 4.788. This indicates that, on average, African countries in the sample experienced moderate economic growth during the period analyzed. The minimum GDP growth rate of -30.145 suggests severe economic contractions in some countries, while the maximum growth rate of 26.417 indicates robust economic expansions in others. The relatively high standard deviation points to substantial disparities in economic performance across the continent, with some countries experiencing strong growth while others faced significant challenges.

Table 1: Variable Summary Statistics

Variable	N	Mean	SD	Min	Max
LABOUR	416	42.981	5.221	30.018	50.663
FDI	416	5.501	13.744	-11.199	161.824
EXCHANGE	416	652.308	1323.236	9.544	9565.082
INFLATION	416	5.294	7.464	-3.503	72.826
GDP	416	4.013	4.788	-30.145	26.417

4.1.1 Trend Plot

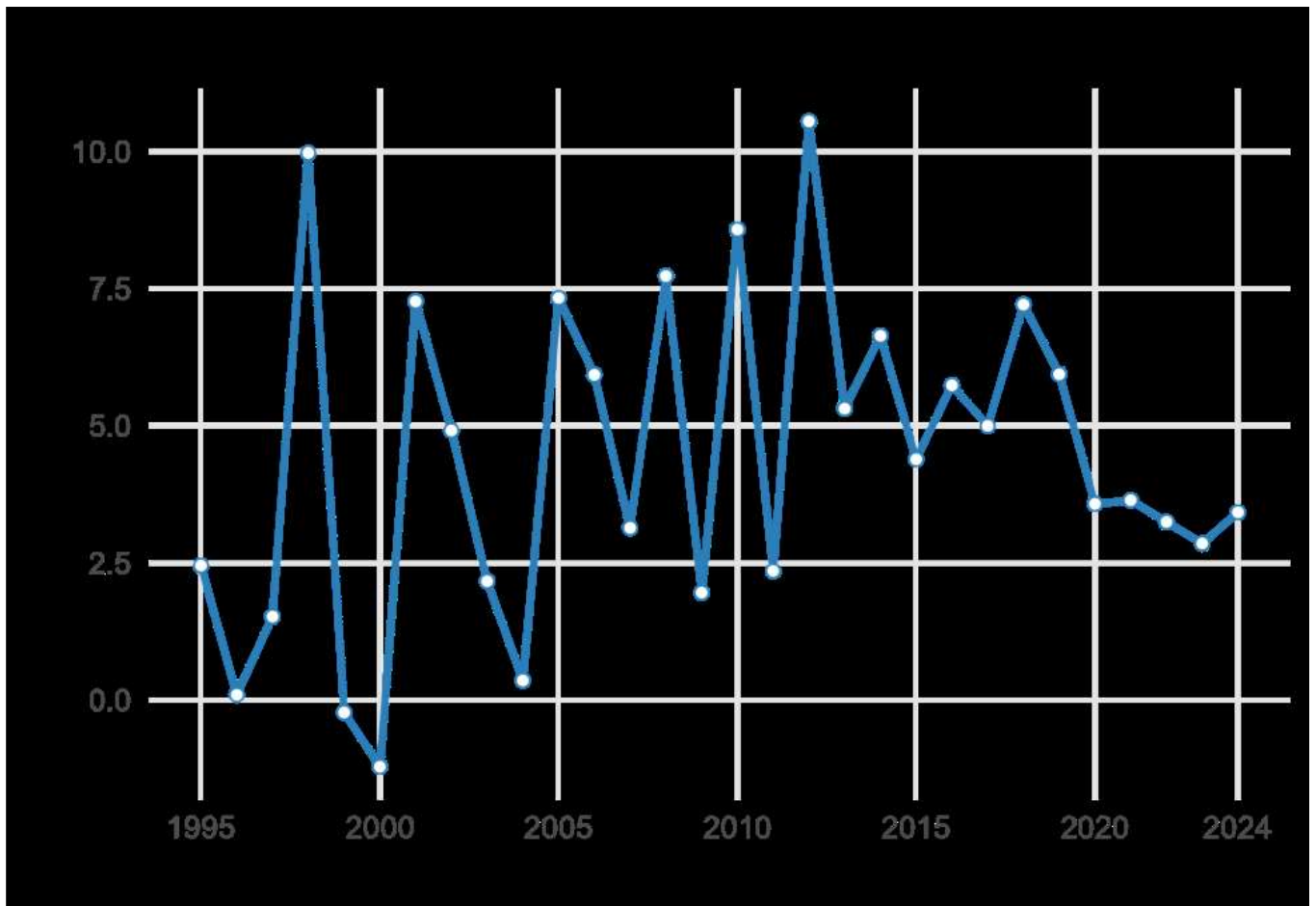


Figure 1: Line graph of Nigeria GDP growth

The line graph in Figure 4.1 presents the trend of Nigeria's GDP growth rate from 1995 to 2024. The graph shows significant fluctuations, reflecting a pattern of economic volatility throughout the period. There were several episodes of rapid economic growth, such as around 1999, 2004, 2010, and 2012, where the GDP growth rate peaked. However, these peaks were often followed by sharp declines, including periods of near-zero or negative growth, particularly around 2000, 2009, and in the early 2020s. The data suggest that Nigeria's economy is highly sensitive to both internal and external shocks, possibly driven by oil price volatility, exchange rate instability, and inflationary pressures. In the more recent years from 2016 onwards, GDP growth appears to have trended downward, indicating slower economic recovery and reduced growth momentum.

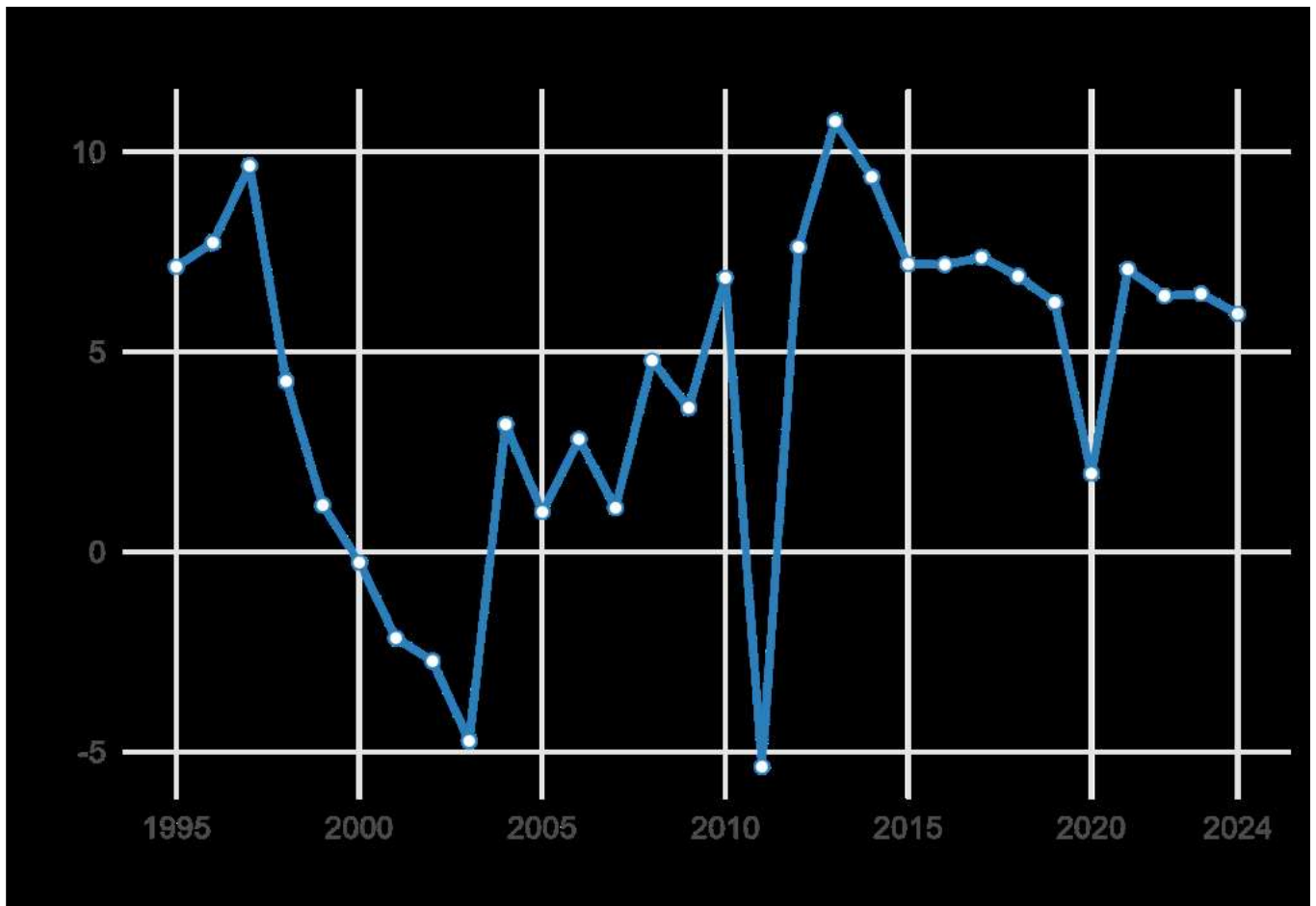


Figure 2: Line graph of Cote d ivoire GDP growth

Figure 2 illustrates the GDP growth rate of Côte d'Ivoire from 1995 to 2024. Compared to Nigeria, Côte d'Ivoire's growth pattern shows a more stable trajectory. While the country experienced a sharp decline in growth around 2000 to 2003, including negative growth rates, it rebounded strongly starting around 2011. This recovery was likely supported by post-conflict reconstruction, investment inflows, and structural reforms. From 2012 onwards, the graph reveals sustained and relatively high economic growth, with the GDP growth rate consistently staying above 6%, except for a few moderate declines. This indicates a more resilient and stable economic environment compared to Nigeria, especially in the past decade. Despite a brief dip around 2020, likely linked to global disruptions (e.g., COVID-19), Côte d'Ivoire maintained a strong recovery trend up to 2024.

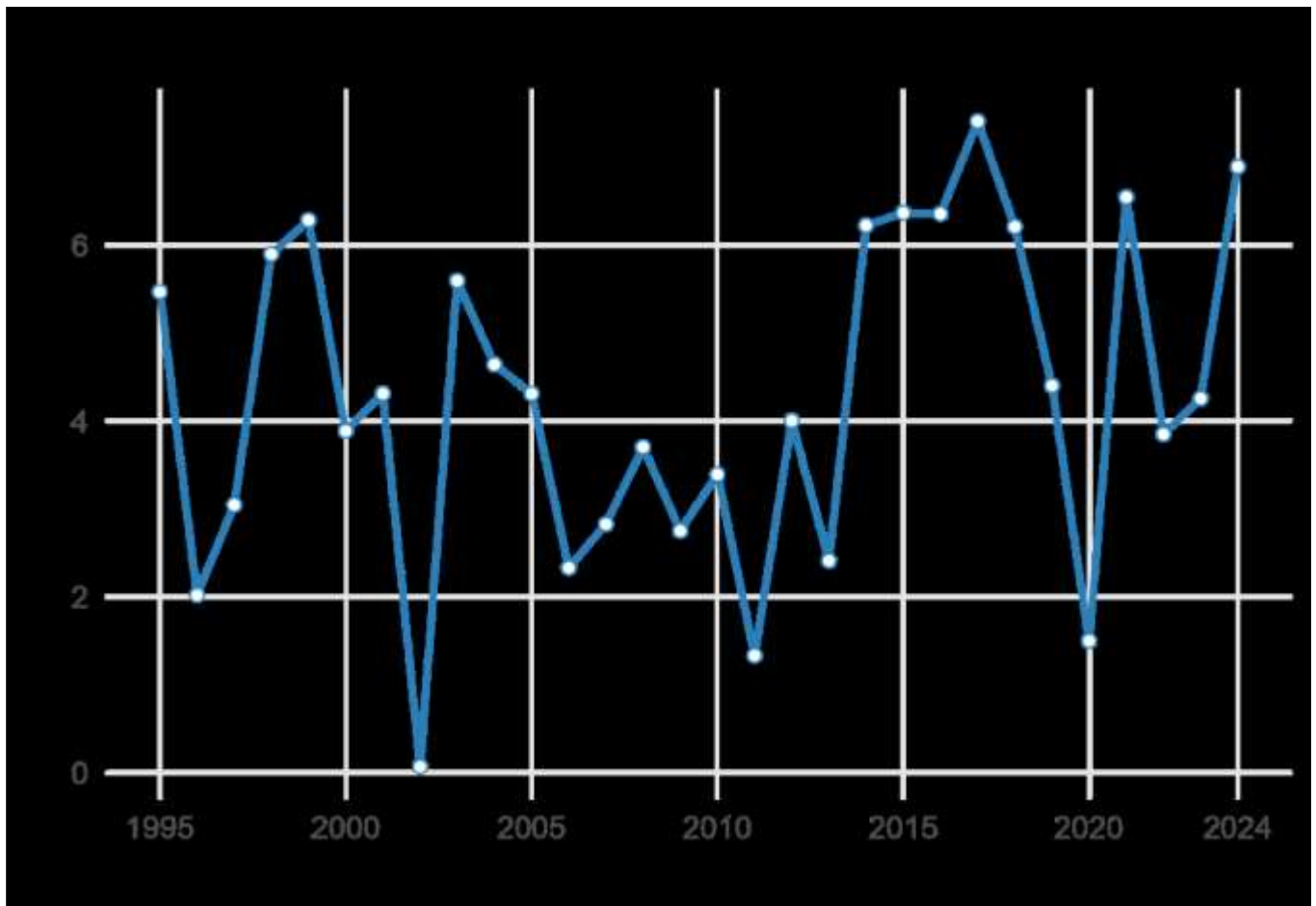


Figure 3: Line graph of Senegal GDP growth

According to Figure 3, this line graph presents the trend of Senegal's GDP growth rate from 1995 to 2024. The graph reveals a pattern of economic volatility with notable fluctuations throughout the period. The economy experienced several periods of growth, particularly around 1998-1999, 2003, 2013-2015, and 2021-2022, where GDP growth rates reached peaks of approximately 6-7%. However, these growth spurts were interspersed with significant downturns, including a dramatic contraction to near-zero growth around 2001, recession periods in 2009 and 2020, and a downward trend in 2019.

4.2 Pre-Regression Analysis

4.2.1 Heteroskedasticity Test

In panel data analysis, heteroskedasticity refers to the presence of non-constant variance across the error terms, which can affect the efficiency of estimators and lead to biased statistical inferences. The Modified Wald test was conducted to detect groupwise heteroskedasticity in the fixed effects regression model. The results, as shown in Table 2, reveal a Chi-square test value of 5393.69, with a corresponding p-value of 0.186. Since the p-value is less than 0.05, we do not reject the null hypothesis of homoskedasticity and conclude that there is no significant evidence of heteroskedasticity in the data. This suggests that the variance of the error terms is constant across the groups, and we do not need to consider robust standard error in the analysis.

Table 2: Modified Wald test for Heteroskedasticity

	Coefficient
Chi-square test	5393.69
P-value	0.186

Modified Wald test for groupwise heteroskedasticity in fixed effect regression model.

4.2.2 Breusch-Pagan test for Heteroskedasticity

To further investigate the presence of heteroskedasticity, the Breusch-Pagan LM test was conducted, as presented in Table 3. The results indicate a Chi-square test value of 0.06 with a p-value of 0.4029. Since the p-value is greater than 0.05, we fail to reject the null hypothesis of homoskedasticity. This implies that, according to the Breusch-Pagan test, there is no significant evidence of heteroskedasticity in the model.

Table 3: Breusch-Pagan LM Test

	Coefficient
Chi-square test	0.06
P-value	0.4029

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.2.3 Hausman Test

The Hausman specification test was conducted to determine whether the fixed effects model or the random effects model is more appropriate for the analysis. Table 4 presents the results, showing a Chi-square test value of 6.16 with a p-value of 0.1873. Since the p-value is greater than 0.05, we fail to reject the null hypothesis that the random effects model is consistent and efficient. Therefore, the random effects model is preferred over the fixed effects model for this analysis. This finding suggests that the unobserved individual effects are uncorrelated with the explanatory variables, making the random effects model a suitable choice for estimating the determinants of GDP growth in African countries.

Table 4: Hausman specification test

	Coefficient
Chi-square test	6.16
P-value	0.1873

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.2.4 Test of Cross-Sectional Dependence

Cross-sectional dependence is a common issue in panel data analysis, particularly when the units (countries, in this case) are interconnected or share common shocks. The Breusch-Pagan LM test for cross-sectional independence was employed to test for the presence of cross-sectional dependence in the dataset. As shown in Table 5, the Chi-square test value is 133.062, with a p-value of 0.1957. Since the p-value is greater than 0.05, we fail to reject the null hypothesis of cross-sectional independence. This result suggests that there is no significant evidence of cross-sectional dependence among the countries in the dataset, implying that the errors across the units are uncorrelated.

Table 5: Breusch-Pagan LM Test for Independence

	Coefficient
Chi-square test	133.062
P-value	0.1957

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.2.5 Test for Serial Correlation in Panel Data

Table 6: Wooldridge test for autocorrelation

	Coefficient
F (1, 15)	13.333
P-value	0.0024

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The Wooldridge test for autocorrelation revealed a statistically significant result ($F(1, 15) = 13.333$, $p = 0.0024$), indicating the presence of autocorrelation in the model. The Wooldridge test for autocorrelation result revealed no first-order autocorrelation. Therefore, we fail to reject the null hypothesis and conclude that there is no significant evidence of autocorrelation in the data.

4.3 Estimation of Regression Result

Table 7 presents the results from the Pooled OLS, Fixed Effects, and Random Effects models for all the countries under study. The coefficient for Labor in the Pooled OLS model is 0.00530, indicating a positive but statistically insignificant relationship between labor and GDP growth rate. In the Fixed Effects model, the coefficient becomes negative (-0.270) and remains statistically insignificant, suggesting that within-country variations in labor do not have a significant impact on GDP growth. Similarly, the Random Effects model shows a small negative coefficient of -0.00331, which is also statistically insignificant. The coefficient for FDI in the Pooled OLS model is -0.0326, which is statistically significant at the 10% level ($p < 0.1$). This implies that, on average, a 1% increase in FDI leads to a 0.0326% decrease in GDP growth rate. The Fixed Effects model, however, shows a smaller and statistically insignificant negative coefficient of -0.0189. The Random Effects model also reveals a significant negative relationship between FDI and GDP growth, with a coefficient of -0.0303, significant at the 10% level. These findings indicate that while FDI might be expected to contribute positively to GDP growth, in the African countries studied, higher FDI may be associated with a slight decrease in GDP growth rate.

The coefficient for the Exchange Rate variable is positive across all three models but statistically insignificant. In the Pooled OLS model, the coefficient is 0.000207, indicating a negligible positive relationship between exchange rate and GDP growth. The Fixed Effects model presents a slightly larger coefficient of 0.000379, while the Random Effects model shows a coefficient of 0.000220. currency volatility might dilute the expected effects of exchange rate movements on GDP growth.

The coefficient for Inflation is positive across all models but not statistically significant. The Pooled OLS model shows a coefficient of 0.00664, indicating a positive but insignificant relationship between inflation and GDP growth. The Fixed Effects model reveals a larger coefficient of 0.0432, and the Random Effects model gives a coefficient of 0.0123, both of which are also statistically insignificant.

The Akaike Information Criterion (AIC) values for the three models suggest that the Random Effects model (AIC = 2465.321) provides a better fit for the data compared to the Fixed Effects model (AIC = 2473.182) and the Pooled OLS model (AIC = 2487.072). This indicates that the Random Effects model, which accounts for both within and between-country variations, is more appropriate for explaining the determinants of GDP growth rate in the African countries included in the study.

Table 7: Pooled OLS, Fixed and Random effect model for all Countries.

	(1)	(2)	(3)
Variable	Pooled OLS	Fixed Effect	Random Effect
LABOUR	0.00530 [0.0475]	-0.270 [0.169]	-0.00331 [0.0532]
FDI	-0.326* (-0.0172)	-0.0189 (0.0186)	-0.0303* (0.0174)
EXCHANGE	0.000207 (0.000185)	0.000379 (0.000316)	0.000220 (0.000199)
INFLATION	0.00664 (0.0331)	0.0432 (0.0391)	0.0123 (0.0340)
CONSTANT	3.794* (2.001)	15.25** (7.226)	4.113* (2.245)
OBSERVATIONS	416	416	416
AIC	2487.072	2473.182	2465.321
NUMBER OF COUNTRIES		16	16

Standard error in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ 35

The table presents the results of the panel regression analysis examining the determinants of GDP growth rate across three African countries: Nigeria, Côte d'Ivoire, and Senegal.

Table 8: Country-Level Analysis: Nigeria, Côte d'Ivoire, and Senegal

	(1)	(2)	(3)
Variable	Nigeria,	Côte d'Ivoire	Senegal
LABOUR	-1.479* [0.722]	0.321 [0.611]	0.146 [0.167]
FDI	0.00905 (0.285)	3.901* (1.963)	0.136 (0.229)
EXCHANGE	0.000725 (0.0111)	-0.0216* (0.0111)	0.00355 (0.00556)
INFLATION	0.312 (0.197)	-0.709 (0.474)	-0.151 (0.196)
CONSTANT	68.87** (32.69)	-0.381 (26.97)	-3.261 (7.678)
OBSERVATIONS	26	26	26
R-Squared	0.239	0.302	0.112
COUNTRIES RE	YES	YES	YES

Standard error in parentheses

*** p<0.01, ** p<0.05, * p<0.1 35

[1] Nigeria

For Nigeria, the coefficient for labor is negative and statistically significant at the 10% level ($\beta = -1.479$, $p < 0.1$). This implies that an increase in labor is associated with a reduction in GDP growth rate. The negative relationship may indicate inefficiencies in the labor market or issues related to underemployment, where an increase in labor force does not translate into productivity gains, thus negatively affecting economic growth. Foreign Direct Investment (FDI) and exchange rate show positive coefficients, but neither is statistically significant. This suggests that FDI and exchange rate fluctuations do not have a substantial impact on Nigeria's GDP growth within the period under study. The inflation variable is also positive but not statistically significant, indicating that changes in inflation did not significantly influence GDP growth during the analysis period. The model's constant is positive and significant at the 5% level ($\beta = 68.87$, $p < 0.05$), indicating that when all other variables are held constant, there is an inherent positive growth in Nigeria's GDP.

[2] Côte d'Ivoire

In Côte d'Ivoire, the coefficient for labor is positive but not statistically significant ($\beta = 0.321$), suggesting that labor does not have a significant direct effect on GDP growth in the country during the study period. However, FDI has a positive and statistically significant coefficient at the 10% level ($\beta = 3.901$, $p < 0.1$), indicating that an increase in FDI is associated with higher GDP growth. This finding aligns with economic theory, where FDI can enhance growth by providing capital, technology, and expertise that spur productivity and economic expansion. The exchange rate shows a negative and significant relationship with GDP growth ($\beta = -0.0216$, $p < 0.1$), suggesting that depreciation in the exchange rate negatively impacts GDP growth, possibly due to increased import costs or financial instability. Inflation has a negative coefficient but is not statistically significant, indicating that inflationary pressures do not have a significant impact on GDP growth in Côte d'Ivoire. The constant term is negative but not significant, implying no strong baseline effect on GDP growth when all other factors are held constant.

[3] Senegal

For Senegal, labor shows a positive but statistically insignificant coefficient ($\beta = 0.146$), indicating that changes in labor force do not significantly affect GDP growth. Similarly, FDI has a positive but not statistically significant coefficient ($\beta = 0.136$), suggesting that FDI inflows do not significantly drive GDP growth in Senegal during the period analyzed. The exchange rate also has a positive but insignificant coefficient ($\beta = 0.00355$), indicating no strong impact of exchange rate movements on GDP growth. Inflation exhibits a negative coefficient ($\beta = -0.151$), but it is not statistically significant, suggesting that inflation does not have a substantial impact on GDP growth in Senegal. The constant term is negative but not statistically significant ($\beta = -3.261$), indicating that the baseline GDP growth rate, when controlling for all other variables, is not significantly different from zero.

5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary of Findings

The descriptive analysis revealed notable variability in the key variables examined. The labor force participation rate averaged 42.98% across the sample, with small variability suggesting a relatively consistent labor market. In contrast, Foreign Direct Investment (FDI) displayed substantial variability, with a mean of 5.50 and a standard deviation of 13.74, highlighting significant differences in investment flows across countries. The exchange rate showed extreme fluctuations, with a mean of 652.31 and a standard deviation of 1323.24, reflecting diverse currency stability across the sample. Inflation rates also varied widely, with a mean of 5.29 and a high standard deviation of 7.46, indicating significant disparities in price stability.

The regression results indicated that labor did not significantly impact GDP growth in the pooled OLS, fixed effects, or random effects models. FDI showed a statistically significant negative relationship with GDP growth in the random effects model, suggesting that higher FDI might be associated with reduced growth, contrary to expectations. The exchange rate and inflation coefficients were generally positive but statistically insignificant, indicating that these factors did not have a significant impact on GDP growth.

Country-level analysis provided further insights. For Nigeria, labor had a negative and significant effect on GDP growth, suggesting potential inefficiencies in the labor market. FDI and exchange rates were not significant, and inflation had a positive but non-significant effect. In Côte d'Ivoire, FDI was positively associated with GDP growth, reflecting its role in enhancing economic expansion. Conversely, the exchange rate had a significant negative impact, indicating that currency depreciation negatively affected growth. Inflation did not significantly influence GDP growth. Senegal's analysis revealed that labor, FDI, and exchange rates had positive but non-significant effects, while inflation had a negative and non-significant impact.

5.2 Conclusions

The findings of this study highlight several key insights into the determinants of capital allocation and their effects on economic growth. The analysis underscores the complexity of economic dynamics, where the impact of variables like labor, FDI, exchange rates, and inflation can vary significantly across different contexts. While labor force participation did not consistently influence GDP growth across the models, the negative effect observed in Nigeria suggests that labor market inefficiencies may hinder growth. The varying impacts of FDI across the countries indicate that the benefits of foreign investment may not always align with economic growth expectations. Exchange rate fluctuations and inflation were generally found to have limited significance in the models, suggesting that other factors might be more influential in shaping economic outcomes.

5.3 Recommendations

Based on the study's findings, several recommendations can be made.

To stimulate economic growth, particularly in countries like Nigeria where labor market inefficiencies were observed, policymakers should implement strategies to improve labor productivity and address structural issues within the labor market. This could involve investing in education and training programs to better align skills with market needs.

2. Given the effects of FDI, governments should design policies that attract and retain foreign investment while ensuring that it contributes positively to economic growth. This may include creating a favorable business environment, improving infrastructure, and ensuring political stability.

3. To mitigate the negative impact of exchange rate fluctuations, especially in countries like Côte d'Ivoire where depreciation affected growth, policymakers should implement measures to stabilize the currency. This might involve foreign exchange interventions, promote export diversification, and maintain sound monetary policies.

4. While inflation had limited significance in this study, its potential long-term effects on economic growth warrant attention. Governments should adopt policies to control inflation and ensure price stability, which is crucial for sustainable economic growth.

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