THE IMPACT ASSESSMENT OF CRUDE OIL PRICE VOLATILITY ON THE LABOR MARKET: A CASE STUDY OF GABON FOR THE PERIOD (1990-2022)

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ABSTRACT:
This research explores the dynamic relationship between crude oil price fluctuations and their impact on the labor market, particularly unemployment rates in Gabon during the period 1990-2022. As a country heavily reliant on oil exports, Gabon faces economic vulnerabilities due to uncertainties inherent in global oil markets. The study employs a comprehensive approach encompassing theoretical frameworks, methodologies, and empirical analyses to understand the intricate links between crude oil prices, foreign direct investment, economic growth, and unemployment. The study utilizes the Autoregressive Distributed Lag (ARDL) approach to explore short- and long-run dynamics of the variables under consideration.

The empirical results shed light on a long-term positive relationship between crude oil prices and unemployment attributed to the Dutch Disease phenomenon. It is acknowledged that the impact of foreign direct investment on unemployment is multifaceted, influenced by sectoral focus, technological adoption, and economic diversification. Economic growth initially correlates with a decrease in unemployment rates in the short run but exhibits asymmetric effects over time.

Diagnostic tests confirm the model's reliability with insignificant serial correlation and residue homoscedasticity. Stability tests validate the consistency of data relationships, confirming the enduring relationships between variables.

Keywords: Crude Oil Prices, ARDL, Crude Oil Price Volatility, Economic Diversification.

INTRODUCTION:
In recent decades, the global economy has experienced unprecedented fluctuations in crude oil prices, significantly impacting the economic stability of oil-dependent countries. Gabon, a Central African nation with substantial crude oil reserves, has not been immune to these profound effects. This research paper aims to delve into the complex relationship between crude oil price dynamics and the unemployment rate in Gabon, providing a comprehensive analysis covering the period from 1990 to 2022. Gabon's economic landscape has long been influenced by its reliance on oil exports, making it

particularly vulnerable to the inherent uncertainties in the global oil market. Fluctuations in crude oil prices can lead to cascading effects on various economic indicators, with one critical dimension being the labor market. Unemployment, as a key indicator of economic health, is often directly impacted by

the ebb and flow of oil prices, affecting job opportunities, investment patterns, and overall economic growth.

Understanding the intricate dynamics between crude oil prices and unemployment is essential for formulating effective economic policies, mitigating risks, and promoting sustainable development. This research seeks to contribute to the existing body of knowledge by conducting an in-depth case study of Gabon, uncovering the multifaceted links between crude oil price movements and unemployment trends over the past three decades. The significance of this study lies not only in its ability to deepen our understanding of Gabon's economy but also in providing insights that can benefit policymakers, economists, and stakeholders in developing strategies to mitigate the impact of volatile oil prices on employment. By scrutinizing historical data and employing advanced econometric models, this research aims to offer a precise perspective on causal relationships, delays, and potential policy interventions that can be instrumental in addressing the challenges posed by oil price volatility. As we embark on this analytical journey, we anticipate that the findings of this research will not only enhance our understanding of the complex interaction between crude oil prices and unemployment in Gabon but also serve as a valuable reference for researchers, policymakers, and practitioners grappling with similar challenges in other oil-dependent economies worldwide.

LITERATURE REVIEW:
Unemployment represents a waste of human resources and imposes an additional burden on families and society, hindering the potential for production and development (Khalaf and Hassan, 2023). The relationship between oil prices and employment has attracted considerable attention in empirical studies. For instance, Altay et al. (2013) studied this relationship in Turkey using quarterly data from Q1 2000 to Q4 2012. They found a unidirectional relationship from oil price and income to employment levels in the short term. Moreover, they found that oil prices also cause increases in income and employment opportunities in the long term (Altay et al., 2013).

Tarek et al. (2017) examined the relationship between oil prices and employment in Saudi Arabia for the sample period 1980-2015, using linear and nonlinear autoregressive distributed lag (ARDL) models. They found a positive impact of oil prices on employment levels in both linear and nonlinear ARDL models. Furthermore, they identified asymmetric effects in nonlinear models, where increases in oil prices positively impact employment more than decreases (Yousef Alkhateeb et al., 2017).
In a study by Isiaka et al. (2020) titled "The Relationship Between Oil Price Changes and Unemployment Rate in Nigeria: Using Linear and Nonlinear ARDL Methods," they used quarterly data from 1979 to 2018. The linear ARDL model results showed that oil price changes have little to no effect on the unemployment rate. However, NARDL results indicated that both increases and decreases in oil prices have a significant positive impact on unemployment in the short term. In the long term, rising oil prices worsen unemployment, while decreases have minimal impact. This study also found evidence of a long-term asymmetric relationship between oil prices and unemployment (Raifu et al., 2020).

Dennis (2022) explored the relationship between oil revenues and unemployment rates in Africa, focusing on the eight largest oil exporters over the period 1999-2018, using the Pooled Mean Group (PMG) estimator. The main results indicated that oil rents have a significant negative impact on unemployment in the long term for these countries, while crude oil prices significantly and positively affect unemployment rates in the long term (Baidoo, 2022).

Iman et al. (2019) studied the effects of oil price shocks on unemployment rates in the Middle East and North Africa (MENA) region for oil-exporting and oil-importing countries during 1991-2017

using the nonlinear ARDL approach. They found that positive changes in oil prices have an increasing effect on unemployment rates in oil-exporting countries in the short term. However, in the long term, positive oil price changes significantly increase unemployment rates in both oil-exporting and oil-

importing MENA countries. They also found that negative oil price changes do not have a significant impact on unemployment rates, supporting the Dutch Disease hypothesis in these countries (Issn, 2019).

Dhafer (2016) examined the impact of crude oil price volatility on some economic indicators in Iraq for the period 2009-2014. The study showed that crude oil exports account for 99% of Iraq's exports and contribute 49% to GDP formation. The research recommended revitalizing the manufacturing sector by directing government purchases towards locally produced goods and attracting foreign direct investment to establish industrial and agricultural projects (Dhafer, 2016).

THE OIL WEALTH AND LABOR MARKET IN GABON'S ECONOMY:
Gabon enjoys abundant natural resources, including timber, manganese, natural gas, and crude oil. Forests cover 85% of the country's area, making it the second-largest forest area in Africa. Gabon's exports represent approximately 25% of international trade in manganese, and its proven natural gas reserves were estimated at about 33 billion cubic meters in 2008. Despite this resource diversity, since the mid-1970s, the oil sector has been the cornerstone of the country's economy. In the decade from 2000 onwards, oil represented, on average, 50% of GDP, 60% of government revenues, and 80% of export revenues. Oil reserves were estimated at 3.7 billion barrels in 2011, making it the seventh-largest in Africa, and oil is expected to remain a major sector, albeit declining, in the foreseeable future.

Since independence from France, Gabon has remained relatively politically stable. A one-party system was introduced in 1960 and persisted until 1993. In that year, a multi-party political system was adopted, leading to open elections and the formation of a broad-based coalition government. However, to this day, the ruling Gabonese Democratic Party dominates the political scene, and the multi-party system has not translated into a true system of checks and balances with meaningful civil society participation.

Despite political stability, rich resource bases, and a small population, Gabon's human development indicators are lagging. While per capita income has reached the level of a high-middle-income country, social indicators in Gabon are only slightly better than the rest of Africa. The proportion of the population living in poverty increased from 27% in 1995 to 33% in 2005, and it was estimated to reach 37% in 2010 (Gueye, 2011).
Unemployment was estimated at about 25% of the working population in 2005, with public sector employment increasing by 4.2%, representing 51% of public sector workers, while the private sector saw a slight increase of 0.1%. Most of the employment increase occurred in the crude oil sector (AFDB & OECD, 2007).

Gabon's export structure is dominated by oil, mining, and timber sectors, which account for more than 90% of exports, making the economy vulnerable to global price fluctuations and euro/dollar exchange rate differentials (Personal & Archive, 2017).

The most striking aspect of the labor market is the high youth unemployment rate, which in 2010 was reported to exceed 30%. Additionally, the unemployment rate was higher among young people and women (World Bank, 2012).

The trade balance has been in surplus since 2000. Despite a gradual decline in oil production, higher oil prices helped keep the trade balance in surplus. Gabon's exports increased due to higher oil prices,

with export revenues rising from CFA 2.6 billion in 1999 to CFA 4.9 billion in 2006, and then to CFA 6.1 billion in 2008 (FOU, 2010).

Gabon's revenues from oil exports significantly improved the trade balance and contributed to enhancing the country's financial capacity, allowing for investment in development projects and enhancing economic stability (Gueye, 2011).

graph (1)
Development in oil price in Gabon from 1990-2022
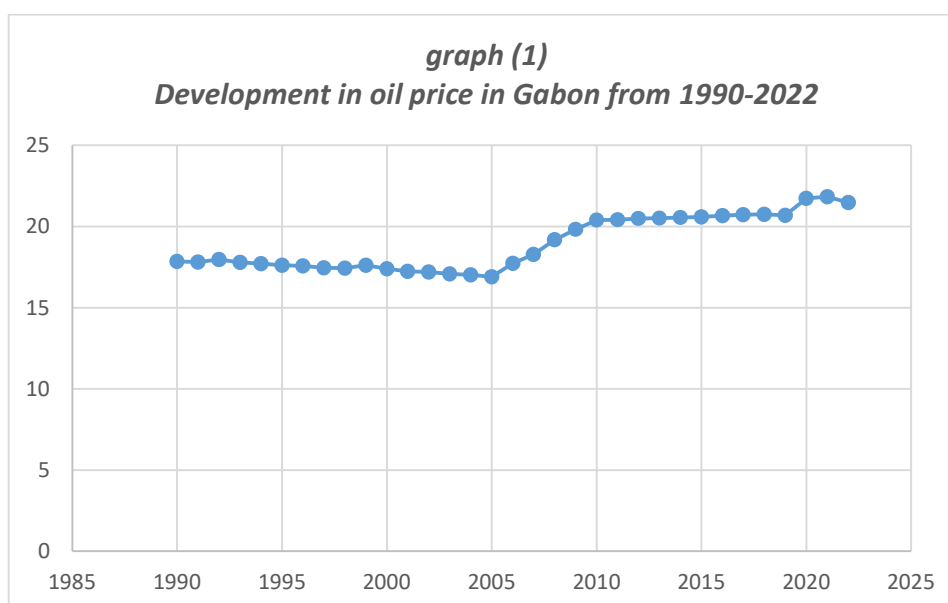
Source: World Bank

The comparison with several countries and groups of countries in different regions of the world, where a national unemployment rate is available, confirmed that the unemployment rate in Gabon is particularly high. Figure (2) below shows that it is about ten times higher than in Cameroon, four times the average for middle-income countries, and two to three times higher than in other selected countries for comparison, except for South Africa and Ethiopia.

THIRD: THE MODEL AND METHODOLOGY
This subsection focuses on the theoretical framework and the econometric methodology used in the study. Given the study's aim, which is to investigate the existence of an asymmetric dynamic relationship between oil price shocks and unemployment, the theoretical framework is based on the model developed by Shapiro & Joseph (Akerlof & Yellen, 2010), later adopted by Bocklet & Baek (Bocklet & Baek, 2017). This model is known as the efficiency wage model. The wage equation is determined as follows:

(1) $w=(\beta,ur)w=f(\beta,ur)$

where w refers to the wage, ur is the unemployment rate, and β represents the level of unemployment benefits. Equation (1) indicates that the wage rate is a function of the level of unemployment benefits and the unemployment rate. In the traditional production function, labor and capital are considered inputs used to produce a certain level of output.

However, with the modernization of the economy, energy has become an important input in production. Considering the three factors of production (capital, labor, and energy), the minimum cost of production, given a unit of output sold at price p, is as follows:

(2) $g(w,ir,op)C=\lambda 1$

where ir is the interest rate, op is the oil price, and λ measures neutral technological progress. If the market is perfectly competitive, there should be no form of profit in equilibrium, which means

$p-c=0$. If p is set to unity due to the assumption of first-degree homogeneity, then equation (2) can be redefined as follows:

$\lambda=g(w,ir,op)$ (3)

To eliminate the wage from equation (3), we substitute equation (1) into equation (3) and rearrange it to obtain equation (4) as follows:

$ur=g(\beta(\lambda),ir,op)$ (4)

Following Bocklet & Baek, the unemployment benefit $\beta(\lambda)$ is replaced with real GDP as a determinant of the unemployment rate. We include the inflation rate and foreign direct investment (FDI) as part of the determinants of the unemployment rate. This has been theoretically demonstrated, similar to the Phillips curve hypothesis, which suggests an inverse relationship between unemployment and inflation. However, the effect of FDI on unemployment can be positive or negative a priori. Therefore, we expand equation (4) to include inflation and FDI, thus obtaining equation (5) as follows:

$ur=f(ir,inf,y,fdi,op)$ (5)

where ur, ir, inf, y, and op are the unemployment rate, interest rate, inflation rate, real GDP, FDI, and oil price, respectively. Equation (5) is transformed into a specified model as follows (Raifu et al., 2020):

$ur_t=a_0+a_1 op_t+a_2 inf_t+a_3 ir_t+a_4 y_t+a_5 fdi_t+\epsilon_t$ (6)

Equation (6) is the long-term equation model that illustrates the impact of each independent variable on the unemployment rate while keeping other independent variables constant.

However, in this study, we apply the Autoregressive Distributed Lag (ARDL) approach proposed by Pesaran et al. (2001). We begin with the ARDL model specification as follows:

$$\Delta ur_t=a_0+a_1 op_{t-1}+a_2 inf_{t-1}+a_3 ir_{t-1}+a_4 y_{t-1}+a_5 fdi_{t-1}+\sum_{i=1}^{n_1}\beta\Delta ur_{t-1}+\sum_{i=1}^{n_1}\delta_i\Delta op_{t-1}+\sum_{i=0}^{n_3}\phi_i\Delta inf_{t-1}+\sum_{i=0}^{n_4}\phi\Delta ir_{t-1}+\sum_{i=0}^{n_5}\gamma\Delta y_{t-1}+\sum_{i=0}^{n_6}\mu_i fdi_{t-1}+\epsilon_t \text{ (7)}$$

where ur is the unemployment rate, op is the crude oil price (OPEC price), inf represents the inflation rate expressed via the natural logarithm of the consumer price index, ir is the real interest rate, y is real income represented by real GDP, and fdi is foreign direct investment.

Δ represents the difference operator. a_0 represents the constant term and expresses the self-adjusting component, while α_1 to α_5 are long-term parameters, and β_i to μ_i are short-term

parameters. $\epsilon t\epsilon t$ is the error term assumed to be normally distributed with constant variance. The null and alternative long-term hypotheses are as follows:

Null hypothesis:$\alpha 1 = \alpha 2 = \alpha 3 = \alpha 4 = \alpha 5 = 0$

Alternative hypothesis: $\alpha 0 \neq \alpha 1 \neq \alpha 2 \neq \alpha 3 \neq \alpha 4 \neq \alpha 5 \neq 0$

The error correction term, which indicates the speed of adjustment from short-term disequilibrium to long-term equilibrium, is as follows:

$\Delta urt=a0+\sum i=1n1\delta i\Delta opt-1+\sum i=0n3\phi i\Delta inft-1+\sum i=0n4\phi\Delta irt-1+\sum i=0n5\gamma\Delta yt-1+\sum i=0n6\mu if di t-1+\epsilon t\Delta urt=a0+\sum i=1n1\delta i\Delta opt-1+\sum i=0n3\phi i\Delta inft-1+\sum i=0n4\phi\Delta irt-1+\sum i=0n5\gamma\Delta yt-1+\sum i=0n6\mu i fdit-1+\epsilon t$ (8)

FOURTH: RESEARCH SAMPLE AND DATA SOURCE

The Gabon economy represents the research sample as it is one of the OPEC members exporting crude oil. Data for variables such as the unemployment rate urur, inflation rate infinf, real interest rate irir,

and real GDP yy were obtained from the World Development Indicators on the World Bank website World Development Indicators. The crude oil price data opop was extracted from the OPEC website OPEC, covering the research period from 1990 to 2022.

FIFTH: ANALYSIS RESULTS
1. UNIT ROOT TEST:

Table (1) presents the results of the stability test, showing that most variables are non-stationary at the level and become stationary after taking the first difference. The variable for the unemployment rate (urur) becomes stationary at the first difference, as do the other variables after the first difference.

Table(1) Augmented Dickey-Fuller test statistic

1st difference		Level		Variable
:Constant ,Linear Trend	Constant	:Constant ,Linear Trend	Constant ,	
-3.24355*	-3.3059**	-2.0946	− 0.64918	ur
-5.004186***	-0.914108	-2.0978	-0.914108	oilp
-5.62589***	-5.6754***	-2.4463	-0.9209	ir
	-5.046427***	-1.513746	-0.261827	y
-12.338***	-	-3.0548	-3.2080**	inf
	-	-5.0488***	-4.5408***	fdi

Not : *, ** , *** value of t-staistic at 10% ,5% ,1% respectively

2. LONG-TERM RELATIONSHIP RESULTS:

Table (2) shows the long-term relationship, indicating that only the variables of crude oil price and foreign direct investment have a statistically significant effect on the unemployment rate, but the correlation was positive.

Table (2) Results of Long-term Analysis

Prob.	t.stitistic	Std.Error	Coefficient	variable
0.0105	2.949975	0.042280	0.124726	oilp***
0.9538	-0.058922	0.109920	-0.006477	ir
0.0028	3.620474	0.022738	0.082322	fdi***
0.8521	-0.189982	0.179995	-0.034196	y
0.4597	0.760252	4.270979	3.247021	C

Not : *, ** , *** value of t-staistic at 10% ,5% ,1% respectively

It can be observed that the rise in crude oil prices ($oilp$oilp) leads to an increase in the unemployment rate in the long term. This is due to the adverse effect known as the "Dutch disease," where an increase in the exchange rate makes imports cheaper and exports more expensive. This can reduce the competitiveness of non-resource-based industries and agriculture, leading to the contraction of these sectors. Ultimately, this results in the shrinking of real production sectors and an increase in the unemployment rate in the economy. Additionally, the extractive industry is capital-intensive and does not absorb a large amount of labor.

As for the variable of foreign direct investment (fdifdi), its impact on the unemployment rate in developing countries that export crude oil can vary based on several factors. The oil industry is often capital-intensive and may not generate a significant number of jobs compared to other sectors (Al-Rubaie, 2022). If foreign direct investment is primarily directed towards the oil sector, it may not significantly reduce unemployment in other industries. The oil industry tends to require a high level of technology and specialized skills. If foreign direct investment leads to the adoption of advanced

technologies, it may create job opportunities for skilled workers but may not significantly impact unemployment among the less skilled population (Asravor & Sackey, 2023).

Some oil-rich developing countries suffer from the "resource curse," where excessive reliance on oil exports can lead to economic imbalances, corruption, and mismanagement (Reader, 2015). In such cases, foreign direct investment may not effectively address unemployment if broader economic

issues are not addressed. In summary, the impact of foreign direct investment on the unemployment rate in developing countries that export crude oil is complex and multifaceted. It depends on how investments are directed, the overall economic policies in place, and the country's ability to diversify its economy beyond the oil sector. Additionally, other factors such as global economic conditions and effective governance play important roles in determining the overall impact.

3. SHORT-TERM ANALYSIS RESULTS:

The results of the Error Correction Model (ECM) using the ARDL approach, as shown in Table (3), highlight both long-term and short-term relationships between the unemployment rate (urur) and its determinants: crude oil prices ($oilp$oilp), foreign direct investment (fdifdi), and GDP growth (yy). In this analysis, the model considers the dynamics of error correction, providing insights into short-term deviations from long-term equilibrium and the speed of adjustment towards this equilibrium.

Let's analyze the economic effects of the coefficients:

1. **Crude Oil Prices ($oilp$oilp)**
   - The coefficient for ($oilp$)D(oilp) is -0.005234, and the coefficient for $D(OILP(-1))$D(OILP(−1)) is -0.037154.
   - The negative coefficients indicate that an increase in crude oil prices has a negative impact on the unemployment rate in the short term. However, the effect diminishes over time (as evidenced by the lagged effect). This can be explained by the initial disruptive impact of rising oil prices on various industries.

2. **Foreign Direct Investment (fdifdi)**
   - The coefficient for (fdi)D(fdi) is 0.007487, and for lagged foreign direct investment variables, it becomes negative over time.
   - In the short term, an increase in foreign direct investment is associated with a rise in the unemployment rate. However, the negative coefficients for lagged foreign direct investment indicate that this relationship reverses in the long term, which may reflect the positive impact of foreign investment on employment in the economy.

3. **GDP Growth (yy)**

- The coefficient for $(y)D(y)$ is -0.205929, and the lagged effects show mixed signs.
- In the short term, higher economic growth is associated with a decrease in the unemployment rate. However, the lagged coefficients indicate some complexities in the relationship over time.

Table (3)ARDL Error Correction Regression Dependent Variable (u)

F-Bound Test			Null Hypothesis : NO levels relationship		
Test Statistic	**value**	**Signif.**		**I(0)**	**I(1)**
F-statistic	13.55389	10%	2.2	3.09	
k	4	5%	2.56	3.49	
		2.5%	2.88	3.87	
		1%	3.29	4.37	

DIAGNOSTIC TESTS:
A. SERIAL CORRELATION TEST:

The Breusch-Godfrey Serial Correlation LM test is conducted to assess whether there is serial correlation, or autocorrelation, in the model residuals, as shown in Table (4). Serial correlation occurs when the residual values are correlated with their lagged values, indicating a potential violation of the independence assumption of the regression model. The test results, particularly the F-statistic and the associated p-values, suggest that there is weak evidence against the null hypothesis of no serial correlation in the residuals. Therefore, based on this test, it appears that the residuals in the model do not exhibit significant serial correlation.

Table (4)

Breusch-Godfrey Serial Correlation LM test:			
F-statistic	0.633496	Prob. F(2,12)	0.5476
Obs*R-squared	2.769487	Prob. Chi-Square(2)	0.2504

B. HETEROSKEDASTICITY TEST:

The heteroskedasticity test, often referred to as the Breusch-Pagan-Godfrey test, evaluates whether the variance of the residuals in the regression model is constant across all levels of the independent variables. Heteroskedasticity, if present, can affect the efficiency and reliability of statistical inferences. Here is the interpretation of the test:

The test results, as shown in Table (5), particularly the F-statistic and the associated p-values, suggest that there is weak evidence against the null hypothesis of homoskedasticity in the residuals. Therefore, based on this test, it appears that the residuals in the model do not exhibit significant heteroskedasticity

Table (5)

Heteroskedasticity Test : Breusch-Pagan-Godfrey			
F-statistic	1.014985	Prob. F(14,14)	0.4891
Obs*R-squared	14.60784	Prob. Chi-Square(14)	0.4055
Scaled explained SS	2.136824	Prob. Chi-Square(14)	0.9999

C. STABILITY TEST:

To ensure that the data used in this study are free from any structural changes, it is necessary to use appropriate tests such as the Cumulative Sum (CUSUM) and the Cumulative Sum of Squares (CUSUM of Squares). These tests are among the most important in this field because they illustrate two key points: the presence of any structural changes in the data, and the consistency of long-term parameters with short-term parameters. Many studies have shown that such tests are often associated with the ARDL methodology. Structural stability of the estimated coefficients for the error correction form of the autoregressive distributed lag model is achieved if the graphical plots of both the CUSUM and CUSUM of Squares tests fall within the critical bounds at the 5% level, as shown in Figures (1) and (2) respectively. In light of most of these studies, we applied the CUSUM and CUSUMSQ tests proposed by Brown, Dublin, and Evans (Brown et al., 1975).

CUSUM of Squares   ----- 5% Significance
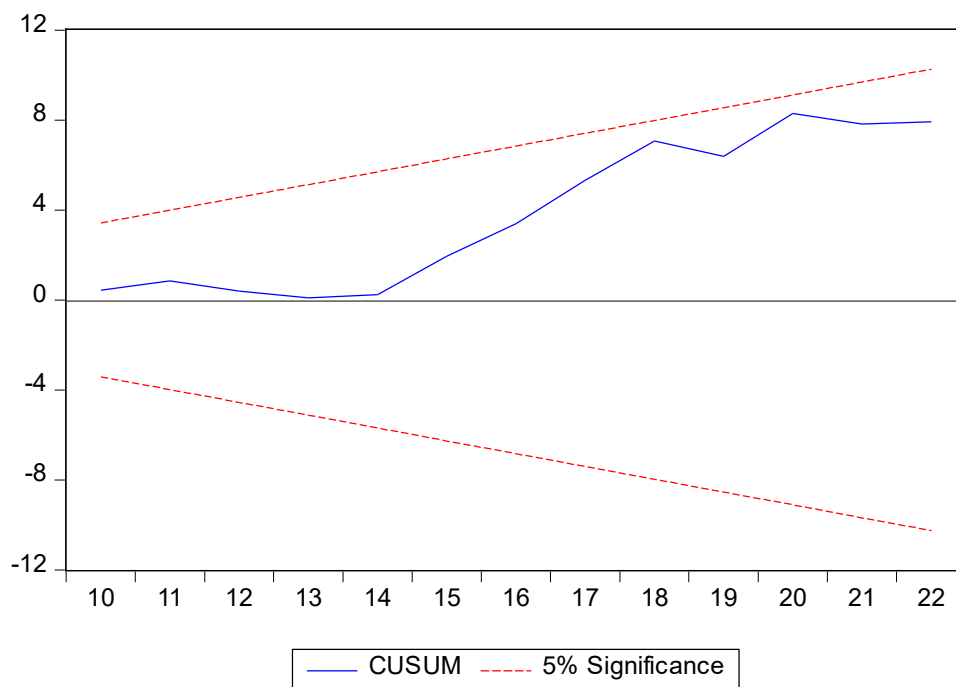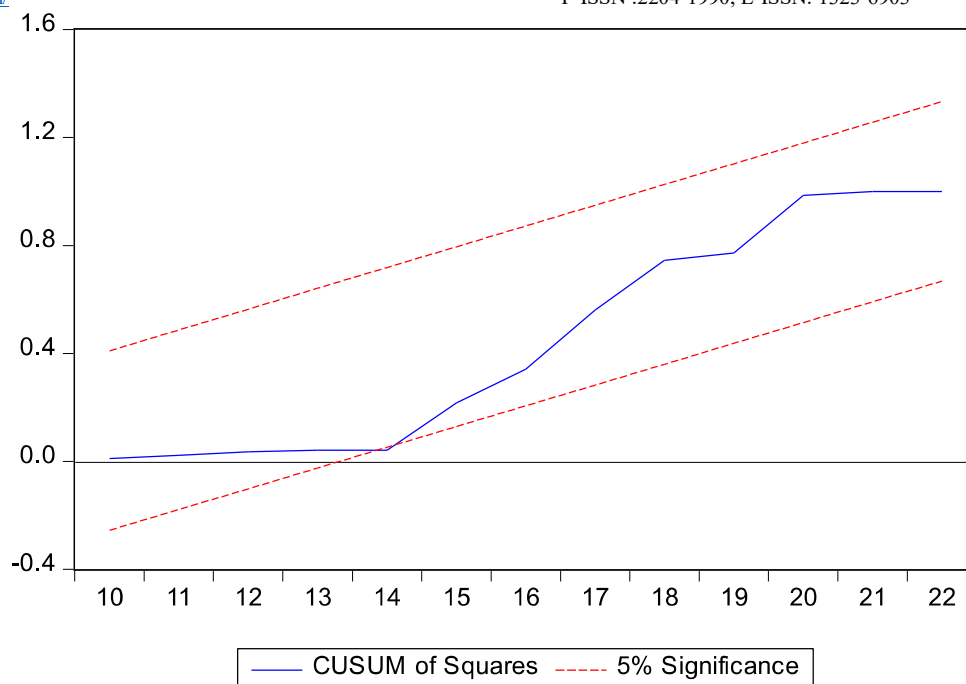
CONCLUSIONS

Crude Oil Prices and Unemployment: The research establishes a positive long-term relationship between crude oil prices and unemployment in Gabon. This is attributed to the Dutch disease phenomenon, where rising oil prices strengthen the currency, making imports cheaper and exports more expensive. This negatively impacts non-resource-dependent industries, leading to contraction and increased unemployment.

Foreign Direct Investment (FDI) and Unemployment: The impact of FDI on unemployment in oil-exporting countries like Gabon is multifaceted. While FDI is initially associated with higher unemployment rates, its long-term effects depend on various factors, including sector focus, technology adoption, and the country's ability to diversify its economy.

Economic Growth and Unemployment: Short-term dynamics indicate that increased economic growth is associated with lower unemployment rates. However, delayed effects complicate the relationship

over time, highlighting the need for careful consideration of temporal dynamics in policy interventions.

Policy Implications: The findings suggest that policies addressing the negative impacts of rising oil prices and promoting economic diversification are crucial for mitigating unemployment. Additionally, policies that encourage strategic FDI, technology adoption, and comprehensive economic reforms are essential for achieving sustainable job opportunities.

Diversification Strategies: Gabon should focus on diversifying its economy beyond the oil sector. Policies aimed at promoting non-resource-based industries can enhance economic resilience and reduce the labor market's exposure to oil price fluctuations.

Technology Adoption: Encouraging FDI that facilitates the adoption of advanced technologies is critical. This can create job opportunities for skilled workers, contributing to a more balanced and sustainable employment landscape.

Comprehensive Economic Policies: Policymakers should implement comprehensive economic policies that address broader issues associated with over-reliance on oil exports, such as economic imbalances, corruption, and mismanagement. Addressing the "resource curse" is essential for effectively reducing unemployment rates. Monitoring and Evaluation: Continuous monitoring and evaluation of policy impacts on unemployment are necessary. Regular assessments of the effectiveness of economic diversification initiatives, FDI strategies, and technological progress will guide policymakers in making data-driven decisions. Global Economic Considerations: Given the global nature of oil markets, Gabon must also consider global economic conditions when formulating its policies. External factors, such as changes in global demand and geopolitical events, can significantly impact the country's economic stability and employment rates. The research provides valuable insights into the complex relationships between crude oil prices, FDI, economic growth, and unemployment in Gabon. The recommendations emphasize the importance of a multifaceted and adaptive policy approach to promote sustainable economic development and reduce long-term unemployment.

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