Research Article

Effect of Crude Oil Price and Production on Nigeria Economic Growth (1974-2023)

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ARTICLE INFO	ABSTRACT
	This research analyzes the influence of Crude Oil Price (COP), Crude Oil Price Volatility (COPV), and Crude Oil Production (COPN) on Nigerian economic performance through their impact on Real Gross Domestic Product (RGDP) and Gross National Product (GNP). The study utilizes Foreign Direct Investment (FDI) as a control variable. Using the Autoregressive Distributed Lag (ARDL) Bounds Test for Cointegration and the Error Correction Model (ECM), the study finds that crude oil price has the strongest positive relationship with Nigeria's economic growth. Crude oil production shows minimal effects, while price volatility has a weak impact. The findings highlight Nigeria's dependence on crude oil price changes and emphasize the need for economic diversification and better investment policies. **Keywords**: crude oil price; crude oil price volatility; crude oil production; cointegration; economic growth; ARDL.

INTRODUCTION

Crude oil is a fundamental natural resource embedded in the geology of many regions worldwide. Its refinement produces essential products such as gasoline and diesel, making it a critical economic driver for oil-rich nations. Countries like Saudi Arabia, the United States, and China closely monitor crude oil price fluctuations due to their significant impact on revenue and demand Gallagher (2017).

Nigeria, Africa's largest oil producer, discovered crude oil in 1956 in Oloibiri, Niger Delta, marking a transformative economic shift (Aduloju and Okwechime, 2016). By 1958, production commenced at 5,100 barrels per day (Edo, 2024). Since then, oil has become Nigeria's primary economic pillar, driving industrial activities and international trade (Aigbedion and Iyayi, 2007). The sector remains crucial to Nigeria's foreign exchange earnings and overall development, contributing approximately US$390 billion in revenue between 1971 and 2005, and helping Nigeria achieve a GDP of US$522.6 billion by 2013 (Sami and Taiwo, 2023).

However, heavy reliance on oil has overshadowed other sectors, particularly agriculture, which was previously the economy's backbone (Okonjo-Iweala and Osafo-Kwaako, 2007). Nigeria's dependence on oil has made it vulnerable to global price fluctuations, with 75% of state revenues tied to crude oil sales, leading to economic instability (Chuku et al., 2011). Despite its vast resources, the country relies on imported refined petroleum due to non-functional local refineries (Olujobi, 2021).

Nigeria's economy is heavily dependent on crude oil, making it highly vulnerable to global price fluctuations. While oil has significantly contributed to the country's GDP, this reliance has exposed Nigeria to severe economic instability (Oladipo et al., 2024). The 2008 global financial crisis and the 2020 COVID-19 pandemic demonstrated how sudden oil price declines can threaten national revenue and economic growth (Jia et al., 2021). Despite previous efforts to create fiscal buffers, Nigeria remains susceptible to external shocks due to inadequate economic diversification (Olayeni and Adekola, 2018).

A critical gap in existing research lies in understanding the mediating role of crude oil production in shaping economic outcomes. Most studies focus on the direct effects of price changes, overlooking how production levels influence economic stability. Increased production during high-price periods can generate additional revenue, while production cuts during

downturns can help stabilize markets but also reduce income (Asongu and Odhiambo, 2019). This study seeks to fill that gap by analyzing the relationship between crude oil prices, production, and economic performance in Nigeria.

By examining historical trends, economic policies, and global market dynamics, this research aims to provide valuable insights for policymakers, economists, and stakeholders. The findings will help in developing strategies to enhance economic resilience, mitigate the adverse effects of oil price volatility, and promote sustainable economic growth beyond oil dependency.

LITERATURE REVIEW

2.1 Conceptual Review

The conceptual review focuses on key variables in this study, including crude oil price, crude oil price volatility, and economic growth. Crude oil prices are a crucial determinant of economic performance, as fluctuations in global oil markets directly impact government revenues, inflation, and investment levels (Aloui and Nguyen, 2020). Ji et al. (2021) assert that oil price volatility arises due to market speculation, geopolitical tensions, and changes in global supply and demand. Additionally, crude oil production plays a mediating role in shaping the economic consequences of oil price fluctuations. Hammes et al. (2022) emphasize that technological advancements, such as hydraulic fracturing, have transformed production dynamics, altering the global supply chain and influencing price stability.

### 2.2 Theoretical Framework

Several economic theories provide insight into the relationship between crude oil prices and economic performance. The Resource Curse Theory argues that resource-rich countries, such as Nigeria, often experience slower economic growth due to overreliance on oil revenues, weak institutional governance, and corruption (Ross, 2015). Auty (1993) expands on this by introducing the Dutch Disease Theory, which explains how resource booms lead to currency appreciation, reducing the competitiveness of other sectors like manufacturing and agriculture. In contrast, Institutional Theory suggests that the impact of resource wealth depends on the strength of a country's institutions (North, 1990). Mohammed et al. (2022) assert that nations with robust governance structures can leverage oil revenues for sustainable development, whereas weak institutions may lead to economic stagnation.

2.3 Empirical Review

Tovar (2020) and Oberndorfer et al. (2019) indicate that oil price volatility negatively affects macroeconomic stability, particularly in oil-dependent nations. Bachmeier and Griffin (2016) found that fluctuations in crude oil prices influence inflation rates, fiscal policies, and investment decisions in emerging economies. A study by Creti and Joets (2019) emphasizes that environmental regulations and renewable energy policies contribute to long-term shifts in oil price trends. In the Nigerian settings, Obioma (2006) found a positive correlation between oil price increases and government expenditure but noted that inefficient management of revenues has led to economic instability. Similarly, Alenoghena (2020) highlight that oil price shocks significantly impact Nigeria's GDP growth, underscoring the need for diversification strategies.

2.4 Summary and Research Gap

The existing literature presents conflicting views on the impact of international oil price fluctuations on Nigeria's economy, with some studies highlighting significant effects while others argue that government policies mitigate these impacts. A major research gap lies in the lack of dynamic analytical methods, often relying on standard deviation rather than more robust volatility measures. Additionally, previous studies inadequately explore the mediating role of crude oil production and policy responses. There is also limited analysis of nonlinear relationships and long-term effects, necessitating further research to provide policymakers with deeper insights for crafting sustainable economic strategies.
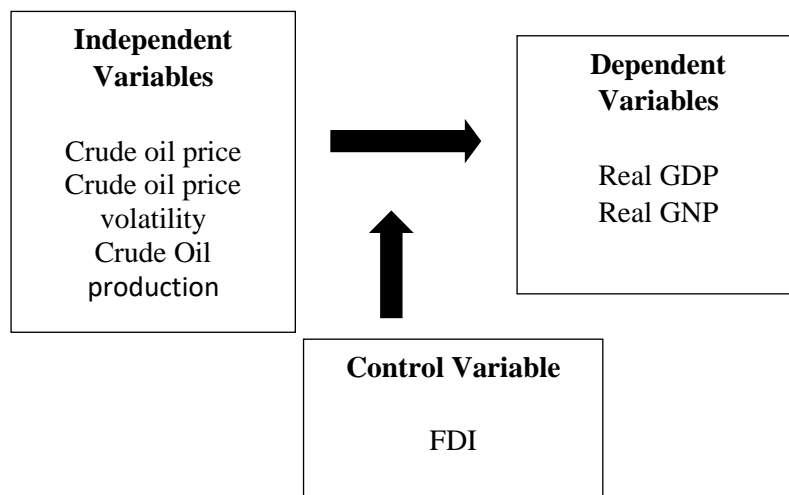
Figure 1: Conceptual Framework

METHODS

3.1 Research Design

This study adopted an ex-post facto research design, which is a non-experimental research method used to analyze historical data and establish cause-and-effect relationships. Since the study investigated the impact of international crude oil prices and crude oil production on Nigeria's economic performance, it did not involve direct manipulation of variables. Instead, it relied on secondary data covering the period from 1974 to 2023. The ARDL model was employed to estimate both short-run and long-run effects of crude oil price fluctuations on economic indicators such as RGDP and GNP. This model was suitable because it handled variables that were stationary at different levels (I(0) and I(1)) without requiring pre-testing for unit roots.

3.2 Population and Sample

The study focused on the Nigerian economy, specifically the petroleum sector, as it played a critical role in government revenue, foreign exchange earnings, and overall economic stability. The key economic indicators examined included COP, COPV, COPN, RGDP, GNP, and FDI as a control variable. Since the study was based on secondary data, a total population sampling technique was used. This meant that all relevant economic data from 1974 to 2023 was included, eliminating the need for a sample size calculation.

3.3 Data Collection

This study relied exclusively on secondary data obtained from credible financial and economic reports, ensuring accuracy and reliability. The sources included Central Bank of Nigeria (CBN) Bulletin, National Bureau of Statistics (NBS) Reports, Organization of Petroleum Exporting Countries (OPEC) Reports, and World Bank and International Monetary Fund (IMF) Economic Reports. The dataset included historical records of crude oil prices, crude oil production levels, GDP, and GNP, spanning from 1974 to 2023. The data collection process ensured that only verified and standardized economic statistics were used to maintain the integrity of the study.

3.4 Data Analysis

The study employed econometric techniques to analyze the relationship between crude oil prices and Nigeria's economic performance. To ensure the validity of the results, the Augmented Dickey-Fuller (ADF) test was conducted to check for unit roots, confirming whether variables were stationary at level I(0) or first difference I(1). The Autoregressive Distributed Lag (ARDL) model was then applied to estimate both short-run and long-run relationships between the dependent and independent variables. To assess whether a long-term equilibrium relationship existed among the variables, the ARDL Bounds Test for cointegration was performed. If cointegration was confirmed, an Error Correction Model (ECM) was utilized to measure the speed at which short-term deviations adjusted back to equilibrium.

RESULTS

4.1 Descriptive Statistics

The descriptive statistics provide insight into the characteristics and behavior of the key economic variables under consideration COP, crude oil price return (COP_RETURN), COPR, FDI, and GNP.

The analysis indicates significant fluctuations in crude oil prices, with an average price of $44.55 per barrel, ranging from $12.70 to $116.88. The high standard deviation of $31.89 reflects volatility, while the positive skewness (1.02) suggests more frequent extreme high prices. The kurtosis (2.80) indicates a nearly normal but slightly flatter distribution.

COP_RETURN shows high volatility, averaging 4.39%, with a maximum of 53.29% and a minimum of -63.87%. The negative skewness (-0.52) suggests sharp declines were more frequent than extreme gains, while the kurtosis (3.37) reflects a slightly heavy-tailed distribution.

COPR, at an average of 1.94 mbpd, shows lower variability, with a standard deviation of 0.34. Its slight negative skewness (-0.47) suggests that lower production values were more common, and the kurtosis (2.35) indicates a flatter distribution.

FDI exhibits high variation, averaging $2.22 billion, with a maximum of $8.84 billion. Its positive skewness (1.36) suggests frequent large inflows, while the kurtosis (3.72) indicates occasional extreme values.

GNP, averaging $207 billion, shows high fluctuations. Its moderate right skew (0.58) suggests larger values were more frequent, with a near-normal kurtosis (2.03). The results highlight that crude oil prices and their returns exhibit high volatility, while crude oil production remains relatively stable. FDI and GNP show wide fluctuations, which could be influenced by economic conditions, policy changes, or external shocks. The presence of skewness in most variables suggests that extreme values play a critical role in shaping the distributions.

4.2 Time Series Analysis and Stationarity Test

Figure 2 illustrates the series' fluctuations and trends, complicating long-term stability analysis. Sharp spikes suggest structural breaks, especially in COP, GDP, and FDI. RGDP and GNP trend upward, while others show high variance. Logarithm transformation was applied to standardize units, stabilize variance, and enhance model accuracy.
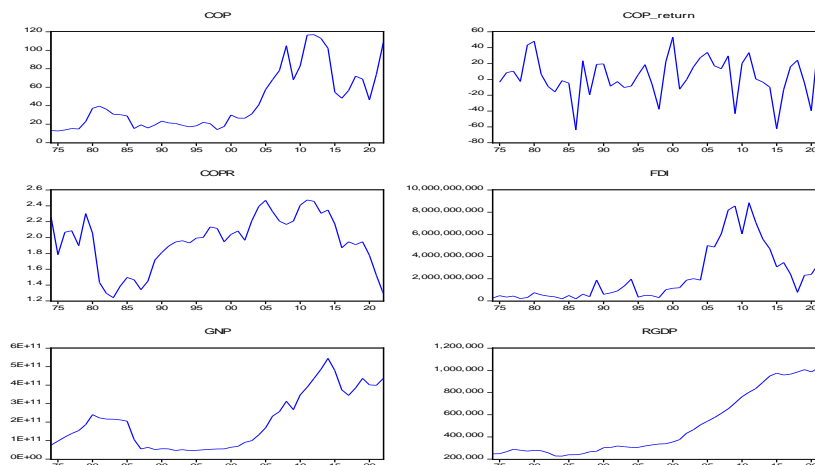
Figure 2: Time Plot of Original Series

Figure 3 presents log-transformed series, appearing smoother than the original. Log transformation minimizes extreme values and stabilizes variance, improving trend interpretation. Despite this, COPR maintains unstable variance, while other variables still exhibit trends. A numerical stationarity test is necessary to confirm the series' suitability for further econometric analysis.
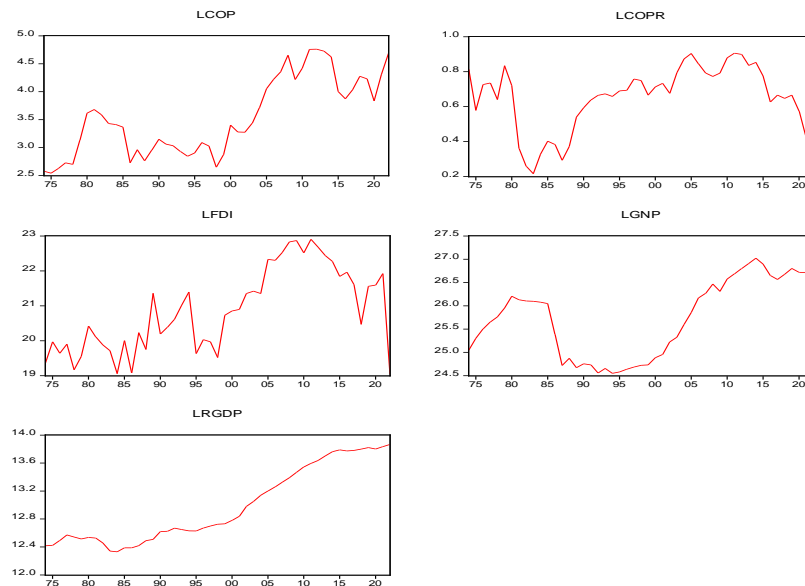
Figure 3: Plot of each series

4.3 Correlation Analysis

Table 1: Correlation Analysis

	LCOP	LCOPR	LFDI	LGNP	LRGDP
LCOP	1.000	0.249	0.722	0.834	0.846
LCOPR	0.249	1.000	0.566	0.083	0.357
LFDI	0.722	0.566	1.000	0.468	0.711
LGNP	0.834	0.083	0.468	1.000	0.739
LRGDP	0.846	0.357	0.711	0.739	1.000

Correlation results show that crude oil price (LCOP) has a strong positive correlation with RGDP (0.846) and GNP (0.834), indicating a significant association between oil prices and economic growth. Crude oil production (LCOPR) exhibits a weak correlation with RGDP (0.357) and GNP (0.083), suggesting a lesser impact on economic performance.

4.4 Crude Oil Price Volatility Analysis (GARCH Model)

The GARCH (1,1) model is suitable for estimating crude oil price volatility, as COP_RETURN shows an average return of 4.39% but a high standard deviation of 26.27%. The model indicates that past volatility significantly impacts future volatility, with the GARCH term (1.3419, p = 0.0138) being statistically significant, while the ARCH term (-0.261, p = 0.1762) is not. This suggests that volatility is highly persistent. The log likelihood value (-217.24) confirms model reliability, and the Durbin-Watson statistic (1.784) indicates no autocorrelation. The generated volatility series was used in further analysis, necessitating a stationarity test.

4.5 Stationarity test using ADF Test

A stationarity test is essential in time-series analysis to determine whether a variable's statistical properties, such as mean and variance, remain constant over time. If a series is non-stationary, it may result in spurious regression, where variables appear significantly related despite having no true connection. The Augmented Dickey-Fuller (ADF) test assesses stationarity by testing the null hypothesis (H₀) that a series has a unit root. A p-value below 0.05 leads to rejecting H₀, indicating stationarity, while a higher p-value requires transformation, such as first differencing.

The ADF test results show that LCOP, LRGDP, LGNP, LFDI, and LCOPR are non-stationary at level but become stationary after first differencing, confirming they are I(1) variables. However, COPV is stationary at level, making it I(0). The mix of I(0) and I(1) variables supports using the ARDL model, ensuring valid econometric analysis for both short-run and long-run relationships.

4.6 ARDL Model and Long-Run Relationships

Impact on RGDP

Crude oil price (LCOP) has a significant long-run effect on RGDP, with a coefficient of 0.1809 (p = 0.0120), implying that a 1% increase in oil price results in a 0.18% GDP increase. Crude oil production (LCOPR) also significantly affects RGDP (coefficient = 0.6493, p = 0.0005), suggesting that increased production boosts economic expansion. Meanwhile, crude oil price volatility (COPV) has a smaller but positive impact (coefficient = 0.0059, p = 0.0252), indicating that price fluctuations contribute modestly to GDP growth. The error correction model (ECM) reveals that 62.53% of deviations in RGDP are corrected annually, demonstrating the economy's resilience to external shocks.

Impact on GNP

Crude oil price (LCOP) has a strong and significant long-run impact on GNP (coefficient = 0.8197, p = 0.0066), reinforcing its importance in national income determination. However, crude oil production (LCOPR) does not significantly influence GNP (coefficient = 0.6446, p = 0.3260), suggesting that increased production does not necessarily translate into higher national income. Crude oil price volatility (COPV) is also statistically insignificant for GNP (coefficient = -0.0041, p = 0.6748), indicating that fluctuations in oil prices do not meaningfully impact national income. The ECM indicates that 56.16% of deviations in GNP are corrected annually, suggesting a moderate adjustment rate to economic shocks.

4.7 Hypothesis Testing

H_{01}: Crude oil price has no significant effect on RGDP (Rejected).

The coefficient of LCOP is 0.1809 with a p-value of 0.0120, indicating a statistically significant positive effect on Real GDP in the long run. This means that fluctuations in crude oil prices significantly influence Nigeria's economic performance.

H_{02}: Crude oil price has no significant effect on GNP (Rejected).

The coefficient of crude oil price (0.8197, p = 0.0066) indicates a strong and significant positive impact on GNP. This suggests that oil price increases drive Nigeria's economic growth both in the short and long run.

H_{03}: Crude oil price volatility has no significant effect on RGDP (Rejected).

The coefficient of COPV is 0.0059 with a p-value of 0.0252, showing a small but significant positive impact on GDP. Although the effect is weaker compared to crude oil price and production, volatility still plays a role in shaping economic growth.

H_{04}: Crude oil price volatility has no significant effect on GNP (Not Rejected).

The coefficient of crude oil price volatility (-0.0041, p = 0.6748) is statistically insignificant, meaning that fluctuations in crude oil prices do not significantly impact GNP.

H_{05}: Crude oil production has no significant effect on RGDP (Rejected).

LCOPR has a highly significant and strong positive effect on GDP (coefficient = 0.6493, p = 0.0005), demonstrating that an increase in production contributes substantially to economic expansion.

H_{06}: Crude oil production has no significant effect on GNP (Not Rejected).

The coefficient of crude oil production (0.6446, p = 0.3260) is not statistically significant, indicating that crude oil production levels do not significantly affect long-run GNP.

4.8 Residual Diagnostics

Table 2: Residual Diagnostics of GDP

Test	Hypothesis	Statistic	p-value
Serial Correlation (Breusch-Godfrey LM Test)	H₀: No serial autocorrelation	0.1568	0.8555
Normality (Jarque-Bera Test)	H₀: Residual is normal	1.6322	0.44
Heteroskedasticity (Breusch-Pagan-Godfrey Test)	H₀: homoskedasticity	0.4463	0.9125

The Breusch-Godfrey Serial Correlation LM Test shows that the p-values 0.8555 is greater than 0.05, indicating no significant autocorrelation in the residuals. This confirms that the model does not suffer from serial correlation, meaning past residuals do not influence future residuals.

The Jarque-Bera normality test results in a p-value of 0.44, which is greater than 0.05, meaning the null hypothesis of normality is rejected. This suggests that the residuals are normally distributed, satisfying an important assumption for valid statistical inference.

The Breusch-Pagan-Godfrey heteroskedasticity test yields p-values of 0.9125 which is above 0.05, meaning the null hypothesis of homoskedasticity is not rejected. This implies that the residuals exhibit constant variance, which is desirable for ensuring the reliability of coefficient estimates.

The analysis examined the impact of COP, COPV, and COPR on Nigeria's economic performance, focusing on RGDP and GNP while incorporating FDI as a control variable. The results confirm that COP significantly impacts both RGDP and GNP, while COPV and COPR have limited influence aligning with prior research on oil-dependent economies (Ugwo et al. 2019). The Bounds Test for Cointegration confirms a long-run relationship between crude oil-related variables and RGDP but provides inconclusive evidence for GNP. This suggests that while crude oil dynamics shape economic output (RGDP), additional macroeconomic factors may influence national income (Sami and Taiwo, 2023).

DISCUSSION

Crude Oil Price and Economic Growth

COP is the most significant driver of economic growth, exerting strong positive effects on both RGDP (0.1809, $p = 0.0120$) and GNP (0.8197, $p = 0.0066$). This supports the resource dependence theory, which suggests that oil-exporting nations like Nigeria benefit from rising oil prices through increased revenue inflows, government spending, and foreign exchange earnings (Boheman and Maxum, 2015). In the short run, COP continues to significantly influence RGDP (0.1131, $p = 0.0091$) and GNP (0.4604, $p = 0.0019$), reinforcing its role as a key economic driver (Ugwo et al., 2019).

Crude Oil Price Volatility and Economic Growth

COPV has a significant effect on RGDP (0.0059, $p = 0.0252$) but an insignificant effect on GNP (-0.0041, $p = 0.6748$). While some studies suggest that volatility can introduce macroeconomic instability (Oyadeji, 2024), the results indicate that Nigeria may have mechanisms such as foreign reserves and fiscal policies to absorb the adverse effects of oil price fluctuations.

Crude Oil Production and Economic Growth

COPR does not significantly influence economic growth in Nigeria. While it positively impacts RGDP (0.6493, $p = 0.0005$), its effect on GNP is not statistically significant (0.6446, $p = 0.3260$). This suggests that increased oil production does not necessarily translate into higher national income, possibly due to issues such as oil theft, mismanagement, or revenue leakages [26]. In the short run, crude oil production remains insignificant for both RGDP and GNP, aligning with economic diversification theory, which cautions against over-reliance on oil production for sustainable long-term growth.

Foreign Direct Investment and Economic Growth

FDI does not significantly impact either RGDP or GNP, with long-run coefficients of -0.0137 (p = 0.2762) for RGDP and -0.0038 (p = 0.9500) for GNP. This finding is consistent with (Ugwo et al., 2019), who highlight that Nigeria's FDI inflows are often concentrated in the oil sector rather than diversified industries, limiting their contribution to broad-based economic growth.

Adjustment to Economic Shocks

The Error Correction Model (ECM) indicates that RGDP (-0.6253, p = 0.0000) adjusts faster than GNP (-0.5616, p = 0.0058) to economic shocks. This suggests that Nigeria's macroeconomic policies are more effective in stabilizing short-term GDP growth than in influencing long-term national income performance.

5.2 Conclusion

This study examined the impact of COP, COPV, COPR on Nigeria's economic performance, focusing on RGDP and GNP, with FDI as a control variable. The findings indicate that crude oil price is the primary determinant of economic growth in Nigeria, significantly influencing both RGDP and GNP in the short and long run. However, crude oil production and price volatility do not have a substantial effect, challenging the assumption that merely increasing production or managing price fluctuations guarantees economic expansion. The insignificant impact of FDI on economic growth suggests that foreign investment inflows are not effectively contributing to productive sectors. The ECM results further reveal that Nigeria's economy adjusts relatively quickly to external shocks, though long-term stability remains vulnerable to oil price fluctuations. These findings underscore Nigeria's continued reliance on petroleum revenues and highlight the urgent need for economic diversification, improved oil resource management, and strategic investment policies. To drive sustainable growth, policymakers should implement measures that reduce economic dependence on crude oil, enhance investment efficiency, and strengthen structural reforms that promote resilience against external economic shocks.

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