SUNTEXT REVIEWS

SunText Review of Economics & Business
ISSN: 2766-4775

Open Access
Research Article
Volume 5:1

Impact of Inflation on Economic Growth: Investigating Some Major Oil Exporting Countries in Africa

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Received date: 31 December 2023; **Accepted date:** 08 January 2024; **Published date:** 13 January 2024

Citation: Bellepea NY, Ozdeser H, Seraj M (2024) Impact of Inflation on Economic Growth: Investigating Some Major Oil Exporting Countries in Africa. SunText Rev Econ Bus 5(1): 201.

DOI: https://doi.org/10.51737/2766-4775.2024.101

Abstract

Based on a PMG-autoregressive framework from 1980 to 2020, this study attempts to show the impact of inflation, money supply, net trade oil price, and economic growth in five selected major oil-exporting African economies (Algeria, Congo, Egypt, Nigeria, and Gabon). Due to cross-sectional dependence and structural breakdowns, the researchers used the Karavias and Tzavalis unit root test despite our variables being at various orders of integration. Subsequently, the panel used a combination of Fisher Johansen and Kao co-integration to demonstrate a long-term link between the variables. The study's outcome reveals a negatively statistically significant short- and long-term association with economic expansion. Furthermore, our findings suggest that when inflation is high, currency devaluation results, and import costs will be higher, potentially diminishing the standard of living. In addition, the study finds a positive relationship between net trade, money supply, and oil prices on economic growth. An increment in any of these factors has a beneficial effect on growth. Consequently, African economies must further lower trade barriers and boost international commerce by decreasing and streamlining processes and restrictions. Also, the study suggests that placing a premium on creating and flexibly deploying monetary policies that encourage expansion is essential.

Keywords: Economic growth; Inflation oil price; Net trade; Money supply

Introduction

The connection between inflation and economic expansion has drawn much interest in the literature on inflation and economics during the last few decades. Given the link between the economies of African oil producers and the oil industry, it stands to reason that the continent's economy is susceptible to shifts in crude oil prices. As a result, the dramatic drop in crude oil prices in 2015 may be directly attributed to the lifting of international sanctions on Iran, which increased Iranian oil shipments. For example, oil dropped from a high of $105 per barrel in 2014 to a low of $37 per barrel in 2016. (IMF, 2016). Many African countries that rely on oil exports are still reeling from the recent drop in oil prices. Consider Nigeria, whose GDP growth dropped from 1.1% in December 2015 to 1.2% in the first quarter of 2016 and continued at that pace through the third quarter of 2016. (NBS, 2016). Even though the average annual increase in production for this economic union was 1.3% in 2015, it was 2.1% in 2014. (IMF, 2016). Most oil-producing nations in Africa, including Algeria, Congo, and Ogede, are likewise concerned with this problem [1,2]. In addition, empirical studies, such as those by Malka, and G. Wang, have provided compelling arguments for examining the relationship between inflation and economic growth [3,4]. However, broad money and the CPI are the primary determinants of economic development, affecting employment opportunities, poverty levels, per capita income, and the quality of life in a country (Phibian, 2010). In Nigeria, attempts to achieve this macroeconomic goal have been fruitless for many years. A lack of understanding of the relationships between the factors may be to blame. Therefore, it is crucial to comprehend the causal links between the money supply and production and their relationship. Consider how efforts to boost economic growth in Africa will be made in response to the desire to promote human welfare. Nevertheless, we know this depends on several variables, including oil prices [5]. The majority of economic sectors rely on oil to meet their energy needs. For

example, energy is needed for transportation in the real estate, services, and financial sectors, industrial processing of goods, and electricity. Therefore, even a modest shift in crude oil prices impacts every sector of an economy. Consider how the cost of manufacturing items, transportation, service delivery, and all other economic sectors increases in response to increased crude oil prices. As a result of the decreased discretionary income brought on by inflation, people's well-being will be greatly impacted. Researchers were interested in elucidating the relationship between the inflation of oil prices and economic growth from a theoretical and empirical standpoint have been drawn to the effects caused by variations in crude oil prices. Oil prices impact economic growth through supply and demand [6]. Oil is a raw commodity used in manufacturing; hence its price changes positively impact the price of manufactured items. This is a result of inflation caused by manufacturers that increase the price of a product to account for their increased manufacturing expenses. Research indicates that crude oil prices positively and negatively impact economic development. Many countries benefited from the price fluctuations, including the United Arab Emirates, Algeria, Iran, Iraq, Kuwait, Libya, Oman, Qatar, and Syria, as shown by studies by Barument [7,8]. In addition, claims that lowering crude oil prices has a significant positive impact on the economies of Saudi Arabia, Ghana, and the Middle Eastern and North African (MENA) states [9]. However, in the United States and Sanchez in the OECD nations found that crude oil prices hurt economic activity [10]. It was determined by Ilhan Oztuk, that the variations in some African counties were the reason for this disparity in effect [11,12]. Some African countries import oil while others export it. Additionally, the disparities were attributed to the study's setting, timing, and sample. Therefore, this study aims to investigate how inflation affects GDP expansion in certain pivotal oil-exporting countries in Africa. Unfortunately, to our knowledge, this research has yet to be conducted in Africa. The expected outcomes will deal with the link between crude oil prices and GDP expansion, the impact of inflation on that link and the use of the autoregressive distributed lag (ARDL) PMG model to examine both the long- and short-term connections between those two variables.

Literature Review

The rise in empirical studies results from the aftermath of the last financial crisis and the turmoil generated globally from analysis of some sovereign African countries—this sharp rise in Inflation on Economic productivity in some major oil-exporting countries in Africa. Many substantive studies have revealed the risk of high and increasing Inflation on Economic Growth. Numerous contributions have argued that high inflation levels on economic activities are primarily harmful in the long term. Although few studies also asserted that inflation positively impacts Economic expansion. Several studies, like ELIAS, use the neoclassical and endogenous models [13]. They wanted to know how commerce with other countries affected the economy of Nigeria and how trade with other countries affected the economy of Nigeria. When conducting their analyses, multiple regression analyses were used to estimate the various international trade components. The study's data, which covered 1980 to 2012, was taken from the 2012 edition of the CBN statistics bulletin. Their analysis demonstrated a considerable influence of export commerce on the expansion of the Nigerian economy. Additionally, their research showed that import trade had no discernible influence on the expansion of the Nigerian economy. Hence, Olawunmi Omitogun looked into the connection between Nigeria's economic growth, revenue fluctuations, and oil prices [14]. Their analysis makes use of secondary data that was collected between 1981 and 2016. The link between the variables over the long and short terms was examined using the ARDL model. The short-term results show that the consumer price index and the exchange rate have a depressing effect on economic expansion. On the other hand, the economy's expansion positively and significantly correlates with oil prices and revenues. Long-term, income from oil has a detrimental effect on economic growth. However, the price of oil, the CPI, and the exchange rate all show positive relationships. Aroyehun Olawale MUSBAU also looked into how the abundance of oil resources affected the economy of Nigeria [15]. In order to accomplish their goal, annual data from the World Bank Development Indicators and the Central Bank of Nigeria (CBN), covering the years 1980 to 2018 gathered (WDI). Oil production was used as a stand-in for the number of oil resources. In comparison, inflation and the exchange rate served as the controls. The data was analyzed using the Autoregressive Distributed Lag (ARDL) Model. The analysis found that in both the long and medium term, Nigeria's economy benefited from the country's abundance of oil resources by 6.9% and 2.2%. The outcome also shows that inflation negatively impacts the Nigerian economy over the long term (-0.9.2%) but has a positive influence over the short term (1.0%) on RGDP. However, the exchange rate had a favorable long-term and short-term influence on the Nigerian economy.

Therefore, evaluated the impact of inflation on economic growth in a developing country's context by using Nigeria's data [16]. This research looks at the correlation between real GDP growth and inflation using data from the Central Bank of Nigeria's (CBN) website for 30 years (1986-2016). In addition, the Augmented Dickey-Fuller test implement to guarantee that the variables remained static (ADF). The Granger causality test was then used to determine the direction of the link between Nigeria's inflation and economic growth. This was done to determine whether or not inflation caused economic development. There was no connection

between Nigeria's rising cost of living and the country's burgeoning economy. In addition, no lagging variable exists in the association between the increase in GDP and inflation in Nigeria. According to the study's findings, this effect does not lead to a rise in either inflation or economic growth. In 2018, research was conducted by several people, including Olugbenga Anthony Adaramola, on the impact that inflation has on the growth of the Nigerian economy. They employ a method that is referred to as autoregressive distributed lag, and it is applied to a variety of parameters. The following variables from 1980-2018 are accounted for in this study: natural GDP, inflation, interest rate, exchange rate, degree of economic openness, money supply, and government consumption expenditures. Based on the data, it can be claimed that the increase in the money supply and the interest rate has a significant and beneficial influence on the development of the economy. However, this is counterbalanced by the fact that inflation and the actual exchange rate have significant detrimental consequences. It was discovered that the other factors in the model did not affect the economy's progress in Nigeria. According to the study's findings on the relationships between variables, the interest rate, the exchange rate, government consumption expenditures, and GDP are all interconnected and affect one another, although in opposing ways. There is no link between openness to trade and inflation or GDP. Koenker and Xiao have gathered a substantial amount of practical information throughout their research on whether or not fluctuations in the price of oil are related to inflation. Changes in the price of oil may have a unique impact on inflation as assessed by the Consumer Price Index. However, the published empirical research has largely neglected this possibility. They employ a quantile regression model to investigate the relationship between changes in oil prices and inflation in the African states that are net exporters of oil. They can capture potential variation and the inflation distribution's progress toward its long-run equilibrium by analyzing the behavior of inflation over a broad range of quantiles. This allows them to study the distribution of inflation. According to the findings of their study, changes in oil prices have a deflationary impact on prices across most quantiles. In addition, the investigation's finding demonstrates a significant disparity between the magnitude estimations and sign estimates of the parameters.

The findings of the quantile regression, for example, indicate that there is hardly any correlation between inflation and oil prices when evaluated at the 5% significance threshold. However, circumstances have changed since we first predicted a drop in the price of oil. Between the quantiles of 0.50 and 0.90, the coefficient has a large and significant negative value. Umar Bala investigated the relationship between shifts in oil prices and inflation in Algeria and Libya and came up with contradictory findings. The study team averaged the prices of Brent, WTI, and Dubai oil. They also considered the natural spot pricing of oil in several other countries. Using dynamic panels with autoregressive distributed latency, we could immediately and later (ARDL) ascertain the outcomes. They concluded that changes in oil prices, whether an increase or a decrease, had a positive influence on inflation. On the other hand, research revealed that the impact was more significant when oil prices were lower. After it was shown that lower oil prices led to higher inflation, researchers looked into other factors. They found that increased food production had the opposite impact. On the other hand, increases in money supply, changes in the exchange rate, and overall economic growth are all positively connected with inflation. The authors of this study, Dahmani use a Structural Vector Autoregressive model to investigate the influence of fluctuations in oil prices on Algeria's economic growth, unemployment rate, level of government revenue, and level of government expenditure from 1970 to 2017 [17]. They adopt a unique approach and a restriction based on the present time to detect structural shocks in the oil price in Algeria. This is done in order to identify the structural shocks. According to the calculations, the favorable change in oil prices has a relatively small but positive influence on GDP growth. However, because of Dutch illness, adverse oil shocks do not have the sound effects they usually would.

Theoretical Framework

The focus of monetarism is on the economy's supply side rather than the market's short-run dynamics. This is one of the defining characteristics of monetarism. On the other hand, monetarism focuses on the long-term supply-side features of the economy rather than the short-term dynamics that are often discussed in economics. This is because monetarists believe long-term supply-side characteristics are more important than short-term dynamics For example, Milton Friedman widely acknowledged the originator of the term; they focused on various essential features of the economy that continue to be relevant in today's society. Two prominent examples of these characteristics are the Quantity Theory of Money and the concept of Monetary Neutrality. The Quantity Theory of Money established a link between rising prices and expanding economies by providing a straightforward relationship between the amount of spending in an economy and the total quantity of money currently in circulation. This enabled the theory to explain the correlation between the two successfully. Nevertheless, according to Friedman's theory, inflation occurs when the expansion of the money supply or the velocity of money increases faster than the expansion of the economy. Friedman's work has cast significant doubt on the validity of the Phillips Curve hypothesis. His argument was based on the hypothetical economic premise that prices would double. It was successful because of this

assumption. As a result of having twice as much disposable income, consumers are unfazed by the fact that the prices of goods and services are double what they were before. As a result, people think about how quickly prices will rise in the future and incorporate it into their calculations. As a direct consequence of this, production and employment levels are unchanged. The "neutrality of money" is a fundamental principle that underpins economics. Suppose actual variables, such as GDP, have equilibrium values unaffected by the amount of money in circulation. In that case, monetary neutrality may be achievable. We have achieved a condition of super neutrality where actual variables, such as GDP growth, are unrelated to the pace of expansion in the money supply over the long term. If inflation operated in this manner, there would be no adverse consequences. On the other hand, inflation has a considerable impact on most of the variables that are considered to be macroeconomic. One of the things that may hold down a nation's economic growth is inflation, which does this by putting a damper on capital investment, exports, and savings. According to the monetarist view, inflation has little to no effect on long-term prices. It is primarily determined by the rate at which new money is created. Inflation is likely to occur if the pace of economic expansion is lower than the rate at which the money supply is increasing. The conventional monetarist view is predicated on the idea that there should be an increase in the total amount of money in circulation. On the other hand, we see the reverse of the predicted link between the two: production costs tend to grow in tandem with price rises. Suppose this increase is more significant than production. In that case, the monetarists' contention that there is an inverse connection between the two is proven.

Data and Methodology

This section of the research discusses the different methods, techniques, and strategies adopted to collect the necessary data for the study. In addition, this section reviews and explains the numerous statistical methods used to assess the study's data collection.

Types of data and sources

In order to arrive at their findings, most research projects use two distinct kinds of information, namely, theoretical knowledge and statistical-econometric analysis. The author of this study used a methodological strategy comparable to the one they had taken in their earlier work. In order to get quantitative information on a wide variety of characteristics, the database of the World Bank was searched. In addition, the Statistical Review of World Energy was consulted for data about oil prices. The research will continue to gather information annually for the next four decades, from 1980 until 2020. This study focuses on the economies of many of Africa's leading oil-exporting nations to compile its findings.

Variables and the measurement of variables

The database of development indicators maintained by the World Bank and the British petroleum statistics repository was used as secondary data sources for this investigation. Each item of data collected for the research was sorted into two categories: factors that were used to explain or explain the results of the inquiry and elements that were not used to describe the findings (dependent and independent variables). We decided to use GDP as a stand-in for economic growth and use it as our dependent variable in this study. Our regressors include inflation, the M1 money supply, net traded value, and oil price.

The economic relationship among our variables can be specified in the equation as follow:

GDP = f(INF, MS, NT, OP)----------EQ1

According to the above relationship, GDP denotes per capita income; INF represents inflation; trade represents net trade, and OP indicates oil price. The fundamental assumption here is that economic growth is proxied by per capita income and regressed on (INF), (MS), (NT), and (OP). Hence, the econometric model and equation can be specified as follows:

$$\ln GDP_{it} = \beta_0 + \beta_1 \ln INF_{it} + \beta_2 \ln MS_{it} + \beta_3 \ln NT_{it} + \beta_4 \ln OP_{it} + \mu_{it}$$----------EQ2

In this equation, ln GDP represents the natural log of GDP per capita, ln INF represents the logarithm of inflation, ln MS represents the natural log of money supply, ln NT represents the logarithm of net trade, and ln OP represents the logarithm of oil price. We consulted the World Development Indicators and the Statistical Review of World Energy to write this piece. The data that we were able to acquire was for the period from 1980 to 2020, and it was collected annually.

Estimation Procedures

Cross-sectional dependency test

The choice of additional econometric tests employed in empirical research, such as co-integration and unit root tests, in panel analysis is heavily influenced by cross-sectional dependence across variables. As a result, it is predicted that cross-sectional dependency will significantly affect the statistical characteristics of panel unit root tests. However, when applied to data series with cross-sectional dependence, first-generation panel unit-root tests exhibit size distortions and insufficient power (O'Connell, 1998). Therefore, this feature must be considered in our panel analysis because of the influence of cross-sectional dependency on test results. In addition, a cross- sectional dependence test may be used

to assess or validate the use of conventional ADF and PP unit root, or employs second-generation panel unit root testing should be used. In addition, Pesaran (2004) proposes an alternative CSD test that does not need a prior model and may be applied to several model parameters. Under the null hypothesis of no cross-sectional dependency, the Pesaran CD test statistic has the following qualities:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{n-1}\sum_{j=i+j}^{n} P_{lj}\right) \rightarrow \widehat{N}(0,1)$$ ----------EQ3

The LM test for CD by Pesaran (2015) can handle slope heterogeneity and cross-sectional issues in a small sample. However, it usually assumes that the observed test statistics for the studied residuals (u) are asymptomatically distributed, thus CD N. (0, 1). The result discussion shows Pesaran's (2015) and Pesaran's (2007) CD testing results. Thus, a unit root test must account for CD limitations to confirm a long-term relationship between variables. This study uses Pesaran's CADF and CIPS panel unit root test. In addition, the Im IPS unit root test was enhanced (2003).

Panel unit root

We cannot continue with the traditional panel unit root tests since our panel has a cross-sectional reliance on the examined variables (also known as first-generation panel unit root tests). As a result, we depend on unit root tests that might potentially take into consideration the use of cross-sectional data, which are of the second generation. The next generation of diagnostic tools will be created using heterogeneity as its primary support structure. We also designed a new version of the original IPS test using its statistical framework, which is referred to as the Cross-sectionally Augmented Dickey-Fuller, or CADF, for short. Even though oil prices have structural fractures, the researcher nonetheless used the unit root test, which was validated using cross-sectional dependence by Karavias and Tzavalis [18]. Because the tests are invariant under the null to the initial condition, there is no need to make any assumptions about the nature of the data prior to carrying out the test, which is not the case with other fixed-T tests. This is in contrast to the situation where assumptions must be made to carry out other fixed-T tests. In addition to being resistant to linear trends, the tests do not depend on the coefficients of the deterministic components. Within the scope of this thesis, we provide xtbunitroot, a brand-new software that executes the panel-data unit-root tests developed by Karavias and Tzavalis. In this study, we presented xtbunitroot, a recently built community-contributed software that employs structural breakdowns in panel data to apply the unit-root tests devised by Karavias and Tzavalis. This program was made possible by the community's contributions (2014). With the use of this first command, panel unit-root testing that includes structural fractures is a possibility. Furthermore, it is possible to test for either one or two structural fractures, depending on the environment. It also allows for errors that are not normal, dependency, and nonlinear trends, as well as heteroscedasticity in cross-sectional analyses. The xtbunitroot command was used for four variables taken from a bank's balance sheet. The results showed that the bank's noninterest income, assets, and equity returns are stable over time. Total assets, on the other hand, do not stay the same over time. In the meanwhile, the idea that Karavias and Tzavalis are discussing may be characterized as follows:

$H_0: w_{i,t} = w_{i,t-1} + \delta_i + \mu_{i,t}$

$H_1: w_{i,t} = \theta w_{i,t-1} + \theta\{\delta_{1,i} I(t \le b) + \delta_{2,i} I(t > b)\} + (1 - \theta)\{\beta_{1,i} I(t \le b) + \beta_{2,i} I(t > b)\} + (1 - \theta)\{\delta_{1,i} I(t \le b) + \delta_{2,i} I(t > b)\} + \mu_{i,t}$----------EQ4

In the above equation, the drift under null hypothesis is δ_i, while the trend coefficient are δ_i and $\delta_{2,i}$.

Panel co-integration test

The validity of this research is examined via the use of three standard panel co-integration tests. These tests are designed to ascertain whether or not a panel analysis constitutes a connection that is sustained throughout time. First, the Pedroni, Kao, and Johansen Fisher co-integration test was used to investigate the degree to which the correlation was stable over time. Second, Pedroni was the first to construct a battery of tests in 1997, 1999, 2000, and 2004 that consider heterogeneity in co-integration analysis. Pedroni created these tests [19]. In Pedroni's test, it is permissible for cointegrated vectors to experience both short-term and long-term variations. The co-integration test developed by Kao considers the variable nature of the co-integration vectors [20]. Nevertheless, hyperbolic equality causes a violation of the criterion that independent variables must be endogenous. This requirement must be met for the model to be valid. In addition, the co-integration test developed by Kao and based on the Engle-Granger framework was used in this research. The Kao test for the existence of a constant may be calculated by determining the long-term variance using the Schwarz criteria and then using the Newey-West estimators to analyze the data. Table 4 displays the findings that may be obtained by applying the test to the panel data set. The relevance of the probability value was highlighted in the findings of the Kao co-integration test, which suggested that the null hypothesis of no co-integration was incorrect and should be rejected. On the other hand, the hypothesis of no co-integration, known as the null hypothesis, was shown to be true. In order to accomplish this, we used the Johansen co-integration test to investigate the co-integrating link between GDP growth and inflation in the leading oil-exporting countries all around Africa. The Sren Johansen co-integration test has the potential to confirm

the co-integration time series. The Johansen method of multivariate co-integration is based on using an error correction formulation of a p-order Vector Autoregressive model with Gaussian error. This formulation is the foundation of the Johansen technique.

$\Delta X_{it} = \emptyset + \sum_{i=1}^{p-1} \gamma_i \Delta X_{t-1} + IIX_{t-pi} + \varepsilon_i$ ----------EQ5

Where Δ is most first difference operator, r_i = -(1-A_1…….A_i) is the coefficient matrix indicating short-run changes, and II denotes by II = -(1-A_1……-A_i) is an n&n matrix, where I is an identity of the matrix whose rank determines amount of co-integrating vectors. However, two likelihood ratio tests were developed by Johansen for testing the number of co-integration vectors ®. Mathematically, the trace test can be expressed as follows:

$\lambda_{trace\ (r)} = -T\sum_{i=r+1}^{g} \ln(1-\lambda_i)$----------EQ6

And maximum eigenvalue test statistics given by:

$\lambda_{ax\ (r,r+1)} = T\ln(1-\lambda)_{i+t}$----------EQ7

Trace statistics check the null hypothesis of no co-integration H0: r = 0 against the alternative of more than 0 co-integration vector H1: r > 0, whereas maximal Eigenvalue statistics test the null hypothesis of r against the alternative of r + 1 co-integrating vectors.

PMG-ARDL Model

The ARDL PMG approach introduced by Pesaran, Shin, and Smith is utilized in this research to investigate both the short-term and the long-term linkages between increases in carbon emissions and increases in GDP [21-30]. The observations obtained from the sample are collated and then averaged using this technique. The PMG estimator is derived from the co-integration version of an ARDL model, which makes it possible for there to be cross-sectional variation in the slope and short-run coefficients as well as the co-integration components. This model's error variances and short-run coefficients are variable across categories, which is a great advantage (heterogeneous). On the other hand, in an ideal scenario, the coefficients would be comparable or even the same over a lengthy period. According to Pesaran the economic policies of different economies differ. The PMG is recommended compared to other panel data models because it enables flexible and limitless short-run responses across groups. Other panel data models do not have these capabilities. Although some short-term benefits may be associated with group consolidation, the long-term implications are restricting. Therefore, it is essential for the functionality of the likelihood-based PMG estimator that the long-run elasticity be the same across all panels. This will ensure that the estimator functions reliably and consistently. In addition to the explanations that have been shown thus far, adopting the PMG-ARDL is beneficial because it is prone to producing outliers even when there is an issue with observing a small sample size in a panel investigation. In the process of doing so, it considers serial correlation and endogenous predators by changing the lag structure of both the dependent and the independent variables. The ARDL (P,q) equation, on the other hand, may be represented in its general form as follows:

$\Delta Y_t = y_{oi} + \sum_{i=1}^{p} \beta_i Y_{t-1} + \sum_{i=0}^{q} \beta_1 X_{t-1} +$

ε_{it} … … … … … … … … … ….....EQ8

The variables in X t can be a co-integrated mixture of I(0) and I(1), which is reflected in the vector Y t. Slope coefficients I and _1; constant y; optimum lag orders i=1; error term vector _it, means zero. It's also a symbol for the vector process of white noise (serially uncorrelated or independent). Based on the general form of the model, we can specify the short-run model as follows:

$\Delta GDP_{it} = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta GDP_{it-j} + \sum_{i=0}^{q} \beta_2 \Delta INF_{it-j} +$

$\sum_{i=0}^{q} \beta_3 \Delta MS_{it-j} + \sum_{i=0}^{q} \beta_4 \Delta NT_{it-j} + \sum_{i=0}^{q} \beta_5 OP_{it-j} + \varepsilon_{it}$----------EQ9

Meanwhile, we can specify the ECM and long-run equation as follows:

$\Delta GDP_{it} = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta GDP_{it-j} + \sum_{i=0}^{q} \beta_2 \Delta INF_{it-j} +$

$\sum_{i=0}^{q} \beta_3 \Delta MS_{it-j} + \sum_{i=0}^{q} \beta_4 \Delta NT_{it-j} + \sum_{i=0}^{q} \beta_5 OP_{it-j} +$

$\delta_{it} ECT_{it-1} + \varepsilon_{it}$ ----------EQ10

Where $\boldsymbol{\delta_{it}}$ it is the long-run adjustment speed, represented by the error correction model's coefficient. This estimator allows for different short-term estimates, error variance, and intercepts among groups of nations while maintaining the same long-term parameters.

Empirical Findings

The table that can be seen above presents and demonstrates the properties of the data that was used in this investigation. In addition, it reveals that our data follows the features of a normal distribution, which is a very significant finding. Using the standard deviation, one could get assessments of the variance for each variable that is more precise and thorough than those obtained using the mean. According to the study's findings, which analyzed 205 different samples, GDP can always be at least zero. On the other hand, inflation has the distribution's minimum value, which is the lowest possible value. The degree to which a series is asymmetric is directly proportional to the degree of skewness shown by one of the variables. All the variables in the table that came before it has a positive skewness, except INF, trade, and oil prices. Two indices, namely the gross domestic product and the money supply, lean more to the right than they should, which is a favourable direction. However, whether a distribution is flat or peaky determines how its kurtosis is measured and characterized.

Flat distributions are more accessible to analyze than peaky ones. As seen in the table, leptokurtic behaviour is shown by both inflation and trade. This points to the peak being located higher up. The table, on the other hand, reveals that the other variables have a playkurtic distribution, which suggests that their distributions are flatter. Using the jaque-bera statistics and probability, we may determine whether or not our variables are distributed jointly. The study does not have a normal distribution, however, since the probability value of the jaque-bera statistics is less than 5%. This indicates that the research does not have a normal distribution. The results of the CSD analysis are shown in the table that can be seen above. The numbers provide evidence against the concept that countries in Africa that are significant oil producers do not experience CSD. As a result, the CSD is favourable for the African nations involved in oil exports. There is considerable evidence of cross-sectional dependence within the series, even if the probability values are highly significant and fall below 5% at all conventional significance levels. This is because the probabilities fall below 5% in all cases. The absence of a cross-sectional dependence is consistent with the conclusion that the null hypothesis ought to be rejected. Due to economic cooperation, cultural engagement, political integration, and globalization, a shock in one nation may have implications in other countries. Because they relied on a cross-sectional sample, the unit root estimates that are obtained from the more conventional ADF and PP panels are, by the econometric methodology, erroneous. The above table presents the result of the stationarity test measured in our analysis. The unit root tests that allow for structural fractures are carried out using the approach devised by Karavias and Tzavalis, as seen in the table that is shown above. These tests permit as many as two structural breakdowns in the deterministic parts of the series. Moreover, they are applicable in both small-T and large-T scenarios, where T is the number of time series observations. Additionally, these tests consider that the number of time series observations in the sample can vary. The assumption that every series in the panel is a unit root process is the null hypothesis. The other possibility is that all the series are stationary, despite breakdowns in the deterministic definition (intercepts and trends). The break dates are the same for all units in the panel. However, the severity of the breaks varies depending on the unit. Moreover, in this case, the decision rules state that a p-value of less than 5% means the alternative to the unit root hypothesis should be preferred. Such conditions imply that our variables are stationary. The result shows that logarithm inflation and oil price are stationary at levels while the remaining variables are stationary. Thus, the findings of our work revealed that we have I(0) and I(1) variables that account for a mixed order of integration.

Once it is known whether or not the factors under consideration are stationary, the standard method is to check for a long-run link between the gauges of the variables. The findings of the Johansen Fisher mixed panel co-integration test are shown and explained in the table that can be seen above. When the probability of the trace statistics is compared to the max-eigen test, the study's findings indicate that co-integration does exist. Despite this criticism, the findings of the analysis indicate that GDP, inflation, the amount of money available for trade, and the price of oil all have a connection over the long term. In addition, the information gives us the ability to estimate the relationships between our regressors using several techniques, which will be beneficial in the long run. For example, we used the Kao co-integration analysis to do more research on stability. The results also provide evidence for long-term correlations between the parameters that are measured in this study. This result indicates that the competing hypothesis—namely, no co-integration—was deemed acceptable. Using the PMG-ARDL model, we have calculated all of the long-term correlations that exist between the regressand and the regressors in the table that is located above. According to the findings, there is a statistically significant link between inflation and the slowing of economic growth. For example, the GDP inflation elasticity is 0.045597% when all other components are held constant. Because of this, it can be concluded that there is a negative impact of inflation on GDP of 0.045597% for every percentage point of inflation. When customers' purchasing power falls as a result of inflation, devaluation takes place in the economy. The table demonstrates that there is a positive relationship between the growth of the money supply and the expansion of the economy, with a 1% rise in the money supply resulting to a 1% expansion in GDP. The chart also demonstrates a statistically significant link between commerce and GDP. A table analysis shows that an increase of 1% in business activity is associated with a 0.081713% increase in GDP. There is a strong positive association between the price of oil and GDP, which brings us to our last point. If nothing else were to change, a one percent increase in oil price would result in a 0.111949% increase in GDP. This assumes that everything else would stay the same. This is because a rise in the price of oil results in increased cash flow for the primary African nations that export oil, resulting in increased economic growth in those countries.

The following table displays the short-term predictions made using the PMG-ARDL model. According to the findings of the study, inflation harms economic growth. This result is in line with the conclusion drawn from the long-run projection. When inflation reduces consumer spending, the elasticity of economic growth concerning inflation lowers by 0.013223 percentage points, as shown by the statistics. This happens because inflation reduces people's discretionary spending. An additional 0.112219% is added to GDP for every 1% rise in the money supply showing a positive relationship between the two. The table also demonstrates a high positive connection between net trade and GDP, with a 1% rise in

net trade leading to a 1% gain in the short term. This is shown by the table containing both of these statistics. If, for example, there is a one percent rise in net trade, then there will be a 0.13136 percent increase in GDP, all other things being equal. Finally, a country's level of commercial activity might provide insight into its prospective economic output. When we look at the data in the table, we can see that oil price has a significant inverse relationship with GDP. This is something that we already knew. The result illustrates a percent rise in oil price declines economic growth by -0.046104%. Finally, the table reveals that the error correction term is negative and statistically significant at all conventional significance levels. The researcher separates the short and long run because of the negative coefficient. However, the table reports that any deviation or distortion from the short-run equilibrium, the velocity at which the economy converges or restores long-run equilibrium, is 37.9099%. The figure above depicts or shows whether our residuals were normally distributed. The null hypothesis argues for normal distribution against the alternative. The decision criteria are such that if the probability value is above 5%, we fail to reject the null hypothesis of normal distribution among residuals. However, given that the probability value of the jarque-bera statistics is less than 0.05, we conclude that our residuals are not normally distributed (Figure 1).

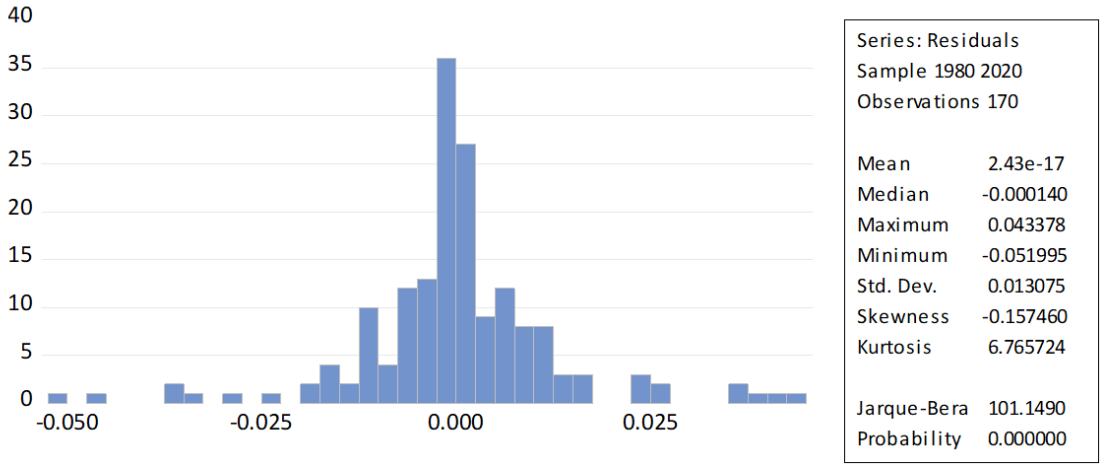

Figure 1: *Residual diagnostics.*

Discussion

This study aimed to determine the relationships among GDP growth, inflation, money supply, trade, and oil price among the top ten oil exporting countries in Africa from 1980 to 2020. Because of the presence of cross-sectional dependence, any change in any variable that is utilized inside a nation may have implications on the economies of neighbouring places. Furthermore, this may happen whenever there is a shift in any variable that is used within the country. This suggests that the economic success of one nation is inextricably linked to the success of other nations. Consequently, ensuring that the variables being utilized were constant was vital for preventing the estimator from arriving at incorrect results. As a consequence, it is essential to provide evidence, in advance of the estimation process, that the series used were stationary, denoted by the symbol I (1). This may be accomplished by using the traditional second-generation unit root tests (CADF and CIPS). Because of the structural holes in our data, however, we decided to utilize the unit root test developed by Karavias and Tzavalis. This test is valid even when the cross-sectional dependency is taken into account. (Table 1-4) contains the solution to the non-stationarity problem that we encountered. As such, our variables were integrated in a different order. After performing the stationarity test, the researchers indicate in table 5 co-integration analysis. Moreover, this table shows whether the variables under scrutiny have a long-run connection. Finally, the researchers employed the combined fisher Johansen panel co-integration test in (Table 5). The result reveals evidence of a long-run connection since the statistics' p-values are highly significant. This test's robustness was verified using the Kao co-integration, the results of which were in line with those of the panel-combined fisher co-integration test. The researchers then used the PMG-ARDL to estimate the relationship, as it allows consistency in long-run coefficients. In addition, the estimation results show our model's long and short-run effects. For example, the coefficient for ECM, which measures the adjustment speed back to equilibrium, was negative, with the range as predicted from 0 – 1 and significant probability values showing 0.379, that is, 37.9% adjustment speed back to equilibrium in the short run. Meanwhile, (Table 6) reports the overall long-term effects of the factors undertaken by the study. It presents a statistically significant association among the variables studied. For example, table 6 reveals a significant inverse correlation to GDP growth in

these major leading oil-exporting African nations. As inflation rises in these nations, their economy experiences a decline in productivity. This is because inflation erodes the purchasing power of a dollar.

Table 1: *List of variables used and sources.*

Variables	Metric	Source
GDP	Per Capita Income	WDI
Inflation	CPI (Percentage)	WDI
Money supply	Broad money, (% of GDP)	WDI
Net trade	Trade(% of GDP)	WDI
Oil Price	World oil price(constant USD)	Statistical Review of world energy
Source: Researcher's Computation		

Table 2: *Descriptive statistics.*

	LGDP	LINF	LMS	LNT	LOP
Mean	8.040010	2.981076	3.421189	4.093673	3.723682
Median	7.900674	2.926021	3.175117	4.129145	3.824000
Maximum	9.197195	4.448769	4.586356	5.055365	4.621290
Minimum	7.236004	-1.27E-05	2.204236	2.212206	2.739272
Std. Dev.	0.552283	0.472669	0.746282	0.548986	0.556081
Skewness	0.657112	-1.009054	0.259375	-0.807137	-0.041521
Kurtosis	2.394411	11.76481	1.487558	4.133167	1.753319
Jarque-Bera	17.88559	690.9759	21.83747	33.22662	13.33447
Probability	0.000131	0.000000	0.000018	0.000000	0.001272
Observations	205	205	205	205	205
Source: Researcher's Computation					

Table 3: *Cross sectional dependency test.*

Test	Statistics	p-value
Breusch-Pagan LM	44.93271	0.0000
Pesaran scaled LM	7.811192	0.0000
Pesaran CD	1.694136	0.0902
Source: Researcher's Computation		

Table 4: *Karavias and Tzavalis (2014) Unit root result.*

Variable	Constant				Constant and Trend				Integrations Order
	level		1st difference		level		1st difference		
	Z- statistic	p-value	Z-statistic	p-value	Z- Statistic	P-Value	Z-statistic	P-Value	
lGDP	-0.0006	0.88	0.1516	0.04	-0.0012	0.75	-0.0996	0.04	I(1)
linf	-4.421	0.06	-18.54	0	-2.7439	0.05	-11.655	0	I(0)
lMS	-0.148	0.18	-2.014	0	-0.0703	0.26	-1.288	0	I(1)

lTRADE	-0.573	0.26	-6.404	0.08	-0.2183	0.27	-4.4063	0.08	I(1)
lOP	-0.686	0	-12.78	0	-0.3372	0	-8.1528	0	I(0)
Source: Researcher's Computation									

Table 5: *Co-integration Test.*

	Trace test	**(P-value)**	**Max-eigen test**	**(P-value)**
None	141.3	0.0000	70.01	(0.0000)
At most 1	79.88	0.0000	44.78	(0.0000)
At most 2	43.62	0.0000	21.34	(0.0188)
At most 3	32.22	0.0004	13.31	(0.2067)
At most 4	50.01	0.0000	50.01	(0.0000)
Kao panel co-integration test			**t-statistics**	**P-value**
ADF			1.979392	0.0239
Source: Researcher's Computation				

Table 6: *Long-run PMG-ARDL Estimation.*

Variables	**Coefficients**	**Std. error**	**P-value**
lINF	-0.045597	0.022855	0.0484
lMS	0.125813	0.028930	0.0000
lNT	0.081713	0.023840	0.0008
lOP	0.111949	0.016820	0.0000
Source: Researcher's Computation			

Table 7: *Short-run PMG-ARDL Estimation.*

Variables	**Coefficients**	**Std. error**	**P-value**
D(lGDP(-1)	0.320743	0.070843	0.0000
D(lINF(-1)	-0.013223	0.001750	0.0000
D(lMS)	0.112219	0.014269	0.0000
D(lNT(-1)	0.131366	0.045417	0.0046
D(lOP)	-0.046104	0.015587	0.0038
ECM(-1)	-0.379099	0.078832	0.0000
Source: Researcher's Computation			

High inflation implies a persistent increase in the general price level, which subsequently increases the cost of production in the long term. The PMG estimates that inflation has a temporary but detrimental impact on long-term growth rates, leading to a permanently lower per capita income than would otherwise be achieved. An extra one percent in inflation is predicted to reduce yearly growth by around 0.045597% over very long periods, reducing steady-state per capita income. Investment levels fall, and productive elements are utilized less effectively due to inflation. Our findings suggest that the marginal cost of inflation is unrelated to the inflation rate. Nevertheless, inflation has significant long-term consequences, and attempts to rein it in will pay off with improved long-term performance and higher per capita income (Table 7).

Meanwhile, the result of this study's inverse connection between inflation and economic growth is consistent with an investigation done by Adaramola. Consistent with table 6, our result finds a significant positive correlation between money supply and economic growth. This relationship is in agreement with the monetarist quantity theory of money. However, the literature of Adaramola also provides a positive association between money supply and growth, which is consistent with our findings. In addition, the study found that nations with high levels of net trade saw higher rates of economic expansion. This research indicates

that international commerce and accelerated economic expansion mutually benefit and considerably contribute to one another. This conclusion is significant for analyzing the development made by other African countries that are comparable to the continents big oil producers since it enables comparisons to be made between the two types of economies. The findings of this research demonstrate the significance of international commerce in developing the economies of several African countries that are major oil exporters. The results, which are both short-term and long-term in nature, provide evidence in support of the idea that trade led to growth. Meanwhile, the findings of this research are consistent with those of a study conducted by Zarra-Nezhad and a study conducted by Brueckner and Lederman. In conclusion, but certainly not least, the PMG result shows a positive long-run correlation between the price of oil and economic growth. Because of this correlation, it comes to reason that as the price of oil increases, the income of the countries that are the world's leading oil exporters will also go up. A rise in profits indicates more money being invested in those countries, which suggests more production. Because of the increase in the number of industrial operations, there may be an acceleration in economic development in the long term. Because these nations rely on money from oil exports, every increase in oil exports leads to an increase in revenues denominated in foreign currency. On the other hand, since these economies are developing, they will import goods and services from other countries, which will cause a drop in the value of their currencies. Consequently, the cost of importing local products will increase while exporting foreign goods will decrease. Because it is more difficult and costly to get them from elsewhere, the prices of imported items will be higher in the context of the nations under consideration. Because a currency devaluation does not affect the price of oil exported, it cannot make exports more appealing, and these nations will not gain from an increase in exports even if those exports were to grow.

Conclusion and Recommendations

This study's objective is to investigate how inflation influences the rate of GDP expansion in important African oil-exporting nations. For this reason, the research relied on a panel of yearly data spanning the five most significant leading African nations of 1980-2020. These countries were Algeria, Congo, Gabon, Egypt, and Nigeria. First, we used the KT unit root that Karavias and Tzavalis provided because our variables were at varied degrees of integration, and there was a cross-sectional dependency. There were structural fractures (2014). After that, dynamic panel ARDL (PMG) models were utilized to investigate the short- and long-term effects of changes in inflation on economic growth. Additionally, the panel combination Fisher Johansen and Kao co-integration was utilized to demonstrate a long-run link among the variables. This helped to demonstrate that there is a connection between the variables. The findings of this study provide credence to past research suggesting that economic expansion is inversely correlated with unemployment rates. We found that excessive inflation harms the value of the national currency and the price of imported items, which might reduce the overall standard of life for the people as a whole. According to this evidence, higher inflation levels over the long run are detrimental to economic development and discourage investment. Research conducted by Adaramola and colleagues lends credence to the notion that inflation and economic expansion go hand in hand (2018). An association exists between the expansion of the money supply and the development of the economy. An increase in the money supply influences economic growth that is both immediate and long-lasting. This effect is known as a multiplier effect.

Consequently, it is of the utmost importance to make the formulation and flexible execution of expansionary monetary policies a top priority. Despite this, the outcomes of this study add validity to the argument that is put forward by the Quantity Theory of Money. This theory maintains that both the income velocity (V) and the price level (P) continue to stay constant. If V and P do not change, then any gain in nominal GDP must be attributed to an increase in the money supply. This is the case even if no other change exists (M). We also found that growth in both the amount of net trade and the money supply positively correlates with economic expansion. As a consequence, the findings of this research lend credibility to the idea that trade is the primary driver of economic expansion for Africa's oil exporters. These countries' relationships with other nations have been a substantial factor in their respective economies' development during the last several decades. Consequently, African economies must further lower trade barriers and boost international commerce by decreasing and streamlining processes and restrictions. These African countries export mostly primary goods, whose prices fluctuate and are influenced by the international market. For an outward-oriented strategy to have a much more significant influence on economic development, the nation should shift from exporting raw materials and semi-manufactured commodities to exporting high-value-added items. In addition, trade policy should encourage investments in capital-intensive industries and build human capital capable of absorbing technology from developed nations. Some limitations of the research cannot be avoided, notwithstanding the efforts that were made. First, this study can only generalize about five of the essential oil-exporting economies in Africa, owing to a need for more data from the rest of the continent. A second issue is that certain regressors may be endogenous, and the omitted variable bias in the estimate procedure may be an issue. Finally, adding additional essential variables to a system of equations where commerce and capital are also affected by other economic

factors would be a worthwhile expansion of this study. As a result, we may better understand the many mechanisms through which inflation influences economic expansion.

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