# Inflation, Economic Growth, and Non-Hydrocarbon Exports in Algeria: Interactions and Implications

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**Abstract:**
This study investigates the relationship between inflation, economic growth and non hydrocarbon exports in Algeria over the period 2000–2024, using an econometric approach including OLS models, stationary tests (ADF, KPSS) and the error correction model (ECM). The results obtained confirm the hypothesis on the existence of a long-term equilibrium relationship (cointegration) relationship between Algeria's non-hydrocarbon exports (NHX) and a set of explanatory variables included in the estimated model, namely: inflation and economic growth (measured by GDP per capita). A positive and statistically significant effect was recorded for GDP per capita on non-hydrocarbon exports in the long run. On the other hand, it was found that Inflation has no statistically significant effect on non-hydrocarbon exports, neither in the short run or in the long run. Furthermore, the error correction model (ECM) indicated a gradual adjustment towards equilibrium with approximately 29% of the deviation from equilibrium corrected each year.

**Keywords**: Non hydrocarbon exports; inflation; economic growth; GDP per capita; OLS model

**Jel Classification Codes :** C22, F13.

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## 1. Introduction:

Algeria is an economy heavily dependent on revenues generated by oil and gas exports, which represent 92.75% of total export volumes, amounting to more than $49 billion in 2024(Bulletin n °69, Bank of Algeria). As, in other oil-exporting countries, exports have played a crucial role in the country's economic growth since independence to the present day. They constitute a driving force for development. However, they are subject to fluctuations and instability due to the country's dependence on a single raw material, hydrocarbons (oil and gas). In addition, they constitute a major challenge to the sustainability of development due to fluctuations in the prices of this raw material. This has led to the need to find alternative sources of income for hydrocarbon exports.

Indeed, Algeria has begun to seek additional sources of income beyond hydrocarbon revenues, to avoid the repercussions of the energy crisis. This has conducted to the adoption of a new development model focused on economic diversification and stability through the promotion of productive sectors identified as key drivers such as agriculture, industry, tourism. Moreover, political decision-makers have realized that depending heavily on hydrocarbon revenues made Algerian economy vulnerable to market fluctuations. So, it is forced to diversify its economy in order not only to boost its non-hydrocarbon exports but to face significant socio-economic challenges, including limited industrial competitiveness, inflation environment and infrastructural gaps that affect production costs and export performance.

In this context, export diversification would help reduce the vulnerability of macroeconomic balances to oil prices. Indeed, it is of capital importance, being able to act directly or indirectly on the main macroeconomic determinants such as economic growth, inflation, etc. Thus, the major challenge that Algeria must address very quickly consists not only of pursuing deep structural reforms but also of deploying the necessary means to achieve sustainable and sustained growth.

However, the diversification process is considered highly sensitive to inflationary pressures. With rising inflation, the price of imported inputs and production costs may increase, making Algerian non-hydrocarbon products uncompetitive on global markets. Similarly, the devaluation of the Algerian dinar, often accompanied by inflation, could boost external competitiveness in the short term by making domestic products cheaper than those sold on foreign markets.

Understanding the interaction between inflation, economic growth and Non hydrocarbon exports is essential to assess Algeria’s economic resilience and long-term development prospects. Analyzing these relationships helps policymakers identify strategies to control inflation, stimulate sustainable growth, and strengthen

the contribution of non hydrocarbon sectors to national income and export performance.

To achieve this, it is imperative to develop non-oil exports and export capacity, which depends on the desire to create favorable conditions for exporting companies to guarantee Algeria's macroeconomic stability. To achieve this, it is imperative to develop non-oil exports and export capacities, which is based on the desire to create favorable conditions for exporting companies by reducing production costs and improving international competitiveness in order to guarantee Algeria's macroeconomic stability.

This study seeks to analyze the relationship between inflation, economic growth and non hydrocarbon exports in Algeria. It aims to examine how inflationary trends influence the performance of NHE and to what extent economic growth contributes to export diversification. By exploring these interconnections, the research contributes to the boarder discussion on Algeria’s transition toward a more resilient and diversified economic model.

### 1.1. The problematic

This research question addresses the lack of understanding of the relationship between economic growth, inflation, and non-hydrocarbon exports, particularly in Algeria. Despite the theoretical debate and empirical studies on this topic, a thorough analysis, based on data specific to Algeria, is necessary to support policy decisions and macroeconomic management. This leads us to pose the following main question: How do changes in inflation (CPI) and economic growth (GDP per capita) affect Algeria’s non-hydrocarbon exports between 2000 and 2024?

Additionally, this main Question is supported by several sub-questions as follows:

- What is the impact of economic growth on Algeria’s non hydrocarbon exports?
- How does inflation affect the performance of Algeria’s non-hydrocarbon exports?
- Is there a short-term versus long-term relationship between inflation, economic growth, and non-hydrocarbon exports in Algeria?

### 1.2. Study hypothesis

Based on the existing literature and theoretical frameworks, the research hypothesis posits a significant relationship between inflation, economic growth and non-hydrocarbon exports in Algeria. Specifically, this research entails the following hypotheses:

**H1:** Inflation has no significant effect on non-hydrocarbon exports (NHX).

**H2**: GDP per capita positively and significantly influences non-hydrocarbon exports (NHX).

**H3:** There is a long-term relationship between non-hydrocarbon exports (NHX), inflation (Inf) and GDP per capita (GDPc)

These hypotheses will be tested empirically using econometric models and statistical analysis techniques to assess the magnitude and direction of the relationship between these variables and non hydrocarbon exports in the Algerian context.

### 1.3. Objectives of the Study

The objective of this research is to investigate the impact of inflation and economic growth on non hydrocarbon exports in Algeria. It aims to provide insights into the macroeconomic dynamics of Algeria and contribute to the body of knowledge on monetary policy, inflation management, and economic stability. It involves analyzing historical data, identifying trends, and examining empirical evidence to understand how changes in inflation and GDP per capita influences the export performance of non-energy sectors as well as whether it is an obstacle or a facilitator of diversification strategy of the nation. Thus, for Algeria, whose economy has always been dependent on hydrocarbons, economic diversification has become an imperative, even a strategy focused on promoting non-hydrocarbon exports.

### 1.4. Methodology of the study

To answer the study's problematic, test the validity of proposed hypotheses and achieve the study's objectives, the study adopts a descriptive and analytical approach to examine the trends of non-hydrocarbon exports, economic growth, and inflation in Algeria from 2000-2024. The study relies on secondary data sourced from international and national institutions such as the World Bank, IMF, and Bank of Algeria.

The study employs tables, graphs, and basic correlation analysis to illustrate the historical pattern and trends between these variables. Then, it provides a good understanding of the Algerian scenario with getting into econometric analysis to study the nature of the relationship between the dependant variable (Algeria's non-hydrocarbon exports) and the independent variables.

### 1.5. Previous studies:

The relationship between inflation, economic growth, and Non oil exports has been a topic of significant interest as governments worldwide strive to formulate policies that stimulate economic growth while controlling inflation. This review uses diverse econometric methods to synthesize empirical research examining these dynamics across various countries and contexts. Below, we will highlight the key studies related to this topic:

- **Gylfason Thorvaldur, (1999)**, titled: Exports, Inflation and Growth. This study aims to identify some of the main determinants of exports and economic growth in cross-sectional data from the World Bank covering 160 countries for 1985–94,

using statistical methods to investigate the linkages between the propensity to export and population, per capita income, agriculture, primary exports and inflation . Then, this study analyzes the relationship between economic growth and some of the above-mentioned determinants of exports in addition to investment. The study concluded that in the period under review, high inflation and an abundance of natural resources tended to be associated with low exports and slow growth.

- **Arawatari, R et al (2018),** titled: On the nonlinear relationship between inflation and growth: A theoretical exposition. This study examined the relationship between inflation and growth using an R&D-based model of endogenous growth in which the R&D abilities of agents are heterogeneous. They found that if the distribution of ability has a fat and long tail, the relationship between inflation and growth becomes nonlinear. The study also revealed that the negative relationship between inflation and growth is weaker in the heterogeneous ability economy than it is in the homogeneous ability economy for low inflation, whereas the opposite outcome holds for high inflation. Furthermore, they found when inflation exceeds a threshold level of 15–20%, a sharp decline in the long-run growth rate of income is observed.
- **AHMED R et al (2018),** titled: An empirical analysis of export, import and inflation: A case of PAKISTAN. This study analyzed data from Pakistan from July 2001 through June 2017, employing error correction model to examine the short run association amongst the variables, as well as, using Johansen cointegration to investigate the long run association amongst the variables. Furthermore, The Granger causality approach has been applied to check the causal directionality between the pair of variables. Their results also indicated that in a long run 1% increase in exports and imports cause 0.63% and 0.57% increase in the CPI (inflation) correspondingly. However, the coefficient of predictable error correlation signifies that approximately 1.18% deviance of inflation rate through the long run level of equilibrium has been adjusted every year, while, they did not find evidence of Granger causality and Toda Yamamoto causality in case of Pakistani economy.
- **Benzeghioua Mohamed, (2024)**, in his study titled “the mutual impact between the economic growth rate and the growth rate of exports outside the hydrocarbon sector in Algeria “, presented the efforts made by the state to increase the value of exports outside the hydrocarbon sector, through economic and trade policies, and the legislation and regulatory laws that the state has set for this purpose. Also, he presented the reality of economic growth in Algeria, with the reality and nature of exports in Algeria,. This study used the descriptive analytical approach to address this issue Furthermore; the study concluded that the economic growth rate has an

impact on increasing the rate of exports outside the hydrocarbon sector, but at a weak rate, despite all the efforts made by the state to promote it.

- **MEBTOUCHE E and BOUADOU F, (2022),** titled: The impact, of inflation on economic growth in Algeria - a record study during the period (2000 - 2020), Journal of Economic Integration, Vol: 10 - N°: 04 / (December 2022) pp: 236-247. This study aimed to analyze the impact of inflation on economic growth in Algeria during the period (2000-2020), by reviewing the theoretical framework of the relationship between inflation and economic growth, while addressing the development of inflation and economic growth. They used econometric methods through cointegration and the autoregressive model of decelerated distributed time gaps. Furthermore, the study concluded that there is a long-term equilibrium relationship between inflation and economic growth in Algeria during the study period 2000-2020.
- **Akbar T (2023),** titled: The effect of inflation, export- import and interest rates on sales through GDP/GDP moderation variables (Case Study of a Pharmaceutical SOE Holding Company in 2018- 2022. This study aims to determine the effect of inflation, export-import, and interest rates on sales in state owned pharmaceutical holding companies with moderating variables of Gross Domestic Product (GDP), using a research instrument in the form of a questionnaire and a Data analysis techniques use multiple linear regression analysis and Moderating Regression Analysis. Their findings suggested that the variables of inflation, export-import and interest rates had a positive and significant effect on sales simultaneously. At the same time, GDP partially affects sales, but cannot moderate the influence of inflation and exports-imports.

Unlike the works cited above and many others, this study examines the issue of the interaction between economic growth, inflation, and non-hydrocarbon exports in the Algerian context from 2000 to 2024 using an OLS (cointegration) model.

## 2. Theoretical Framework

The Algerian economy has traditionally been heavily dependent on the hydrocarbon sector. As part of economic diversification efforts, the development of non-hydrocarbon exports has become a strategic priority. These exports are influenced by various macroeconomic factors, including economic growth and price stability. This study seeks to theorically explore the evolution and dynamics of these interactions.

### 2.1 Evolution of Algerian non oil exports

Since no country can meet all its needs alone, economic liberalization plays an important role in production processes and consumption decisions. Indeed, all countries in the world can exchange goods and services that belong to them to balance their resources. Exports have always been the driving force of economic

growth in developing countries and considered as one of the economic sectors that play an important role through the expansion of the market between several countries (Baldwin, 2005). However, being subject to enormous fluctuations following changes in prices and quantities in the energy sector, Algeria has begun, since the beginning of the 2000s, to direct its efforts towards the adoption of new models based on economic diversification through the revitalization of non-hydrocarbon sectors such as agriculture, tourism, etc.

Table 1 below illustrates the development of total Algerian exports which are divided into hydrocarbon exports and non-hydrocarbon exports.

**Table N°1:** Evolution of Total Exports (Hydrocarbon, Non hydrocarbon) in Algeria (2000-2024)

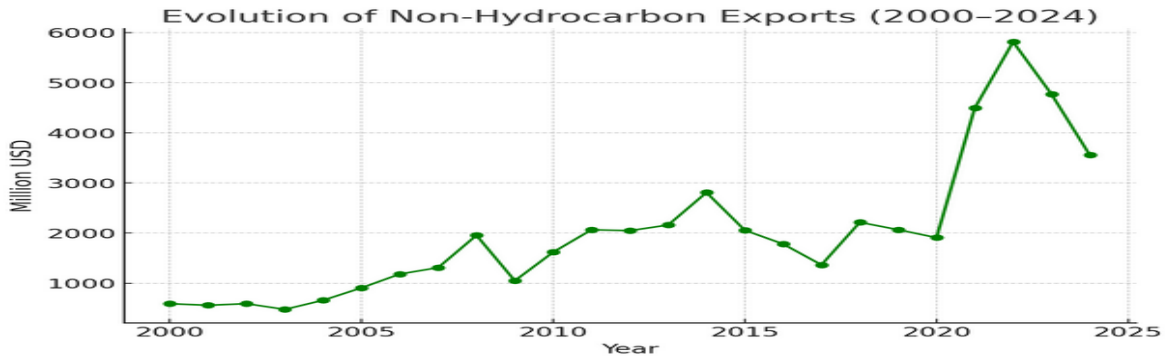
Unit (Million of USD-%)

| Years | Total Exports | Hydrocarbon Exports | | Non-Hydrocarbon Exports | |
|---|---|---|---|---|---|
| | | Value | Share (%) | Value | Share (%) |
| 2000 | 21650 | 21060 | 97,3 | 590 | 2,7 |
| 2001 | 19090 | 18530 | 97,1 | 560 | 2,9 |
| 2002 | 18719 | 18109 | 96,7 | 610 | 3,3 |
| 2003 | 24465 | 23993 | 98,1 | 472 | 1,9 |
| 2004 | 32220 | 31550 | 97,9 | 670 | 2,1 |
| 2005 | 46330 | 45590 | 98,4 | 740 | 1,6 |
| 2006 | 54740 | 53610 | 97,9 | 1130 | 2,1 |
| 2007 | 60590 | 59610 | 98,4 | 980 | 1,6 |
| 2008 | 78589 | 77194 | 98,2 | 1395 | 1,8 |
| 2009 | 45186 | 44415 | 98,3 | 771 | 1,7 |
| 2010 | 57090 | 56121 | 98,3 | 969 | 1,7 |
| 2011 | 72888 | 71661 | 98,3 | 1227 | 1,7 |
| 2012 | 71736 | 70583 | 98,4 | 1153 | 1,6 |
| 2013 | 64867 | 63816 | 98,4 | 1051 | 1,6 |
| 2014 | 60129 | 58462 | 97,2 | 1667 | 2,8 |
| 2015 | 34565 | 33081 | 95,7 | 1485 | 4,3 |
| 2016 | 29309 | 27918 | 95,3 | 1391 | 4,7 |
| 2017 | 34569 | 33202 | 96,0 | 1367 | 4,0 |
| 2018 | 41146 | 38897 | 94,5 | 2249 | 5,5 |
| 2019 | 35323 | 33244 | 94,1 | 2079 | 5,9 |
| 2020 | 21932 | 20022 | 91,29 | 1909 | 8,71 |
| 2021 | 38637 | 34137 | 88,36 | 4495 | 11,64 |
| 2022 | 65716 | 59900 | 91.15 | 5815 | 8.85 |
| 2023 | 55554 | 50781 | 91.41 | 4773 | 8.59 |
| 2024 | 49067 | 45510 | 92.75 | 3557 | 7.25 |

**Source:** Prepared by the researcher based on different reports of Bank of Algeria (2000-2024) Looking at the table above, we see the development path of total exports (oil and non-oil) over twenty-five years. Indeed, over the period studied (2000-2024), total Algerian exports experienced numerous fluctuations.

During the 2000s, the total value of Algerian exports, excluding hydrocarbons, more than doubled, from $21,650 million to $49,067 million. Overall, until 2014, non-hydrocarbon exports accounted for an average of 2% of total exports. In subsequent years, non-hydrocarbon exports recorded increasing growth rates, particularly in 2021, with a rate of 11.64%. However, in the following years (2022-2024), the share of non-hydrocarbon exports declined to 7.25% in 2024. Despite the growth in their value, non-hydrocarbon exports still represent a small share of Algeria's total exports. More specifically, the development of Algeria's non-oil exports can also be illustrated through the following figure:

**Figure No. 01: Evolution of in Algeria during the period (2000-2024)**

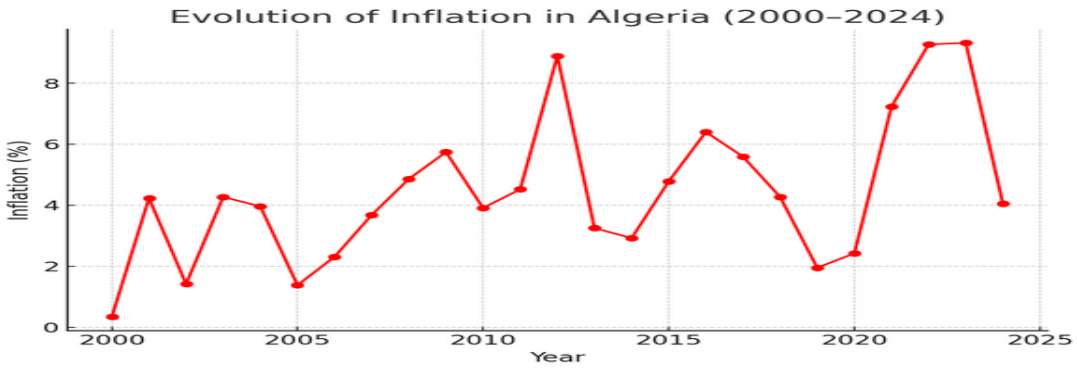



**Source:** Prepared by the researcher based on Table No. 01**.**

## 2.2 Inflation

Inflation is probably the most influential macroeconomic variable, the one with the greatest potential impact on a country's trade performance and economic growth. Persistent inflation in increasingly open economies undermines price stability, increases production costs, and thus compromises the country's international competitiveness. Indeed, most theoretical models postulate that inflation is a monetary phenomenon that continues to preoccupy the attention of politicians and economists in most developing countries and emerging economies. However, like all countries in the world, Algeria is not spared from the harmful impact of this phenomenon, which in recent years has coincided with disruptions in the international supply chain linked to the COVID-19 pandemic and the volatility of international commodity prices.

**Figure 2. The Inflation Rate in Algeria from 2000 to 2024**




***Source:*** Prepared by the researcher based on *World Bank data, 2024.*

From Figure 2, it can be noted that inflation rates have varied considerably over the years ranging from 2000 to 2008; inflation remained relatively contained between 0.34% and 4.8% due to a phase of relative price stability driven by hydrocarbon rents. Nevertheless, there were spikes in 2009 (5.7%) and, more visibly, in 2012 (8.9%), due to internal discrepancy and external price shocks. It is worth noting that there was a significant increase in inflation from 2015 to 2017, reaching a peak of 6.398% in 2016. However, in 2019, the inflation rate dropped to 1.95%, indicating a period of lower inflation. However, in the following years (2020-2024), the inflation rate climbed to 9.32% in 2023 and dropped to 4.05% in 2024.

Globally, we observe, from the figure above, that inflation rates in Algeria have experienced periods of stability and volatility during the period studied (2000-2024). The increase in the money supply without a corresponding increase in production, as well as other structural imbalances from which the Algerian economy suffers, are the cause.

**2.3 Economic growth**

Economic growth measures the increase in wealth produced over a given period. It refers to a positive change in gross domestic product (GDP) over a long period. It serves as the main indicator of a country's economic activity and represents the sum of the gross value added by all producers residing within a country's territory, plus product taxes (fewer subsidies). More precisely, GDP per capita is, according to INSEE, a measure of GDP divided by the total population. GDP per capita provides an indication of a country's average level of wealth.

Due to its dependence on the energy sector and its lack of a diversified base from other sources of growth, Algerian economic growth is unstable and dependent on the hydrocarbon sector. As the graph below shows, the period under study (2000-2024) was characterized by enormous fluctuations.

**Figure 3. The GDP per capita in Algeria from 2000 to 2024**


**Source:** Prepared by researchers based on python using WDI (World Bank, 2024).

We note from figure 3 a fluctuating trend. Indeed, GDP per capita, from 2000 to 2015, experienced growth and a resilient improvement. This upward trend coincided with rising global oil prices, leading to increased revenue from oil. However, GDP per capita declined after 2015, with an insignificant recovery before 2020. This slowdown is, in the period from 2015 to 2020, consistent with falling oil prices and economic difficulties. Furthermore, the decline observed in 2020 would reflect the impact of the COVID-19 pandemic on the Algerian economy, highlighting the vulnerability of Algeria's GDP per capita to oil prices. This would reflect the importance of oil in its economy. However, in the following years (2020-2024), Algeria's GDP per capita continued its ascent, climbing to 4747.3 in 2024.

## 3. Applied study

In this study, we use temporary analysis to examine the relationship between non oil exports, inflation and economic growth in Algeria. To explore this relationship, we follow several steps, we start with the graphical visualization of the variables under study and their statistical descriptions then we operate unit root tests and according to the results of these tests we carry out an examination of the relationship between the variables of interest according to the suitable model.

### 3.1 Specification of the model and variables

#### 3.1.1 Specification of the model

The following model contains three variables, Non-Hydrocarbon Exports (Million USD), GDP per capita and inflation, as well as the trend:

$$NHX=alpha+beta\_1Inf+beta\_2GDPc$$

Where :

NHX : non-hydrocarbon exports (millions USD)

INF: Inflation (%)

GDPc: PIB per capita (USD)

Alpha: Constant term

beta_1, beta_2: Coefficients of regression

e: is white noise

To standardize the units of the variables and to allow an interpretation of the coefficients in terms of elasticities (percentage change), the data are transformed into logarithmic form. This transformation also makes it possible to stabilize the variance of the series and to make the relationships potentially more linear and economically interpretable. The log-log model is formulated as follows:

$$\text{Log (NHX)} = a + b\_1 \log (\text{Inf}) + b\_2 \log$$

### 3.1.2 Variable of research

The dependent variable is the logarithm of Non hydrocarbon exports (LnNHX), which is captured by economic growth. The independent variables represent the logarithm of GDP (LnGDP) and inflation (LnInf) and the trend. These variables are time series, so the methodology followed in the remainder of this paper uses the tools and techniques of time series.

## 3.2 Methodological Approach

Empirical approach advances in three steps:

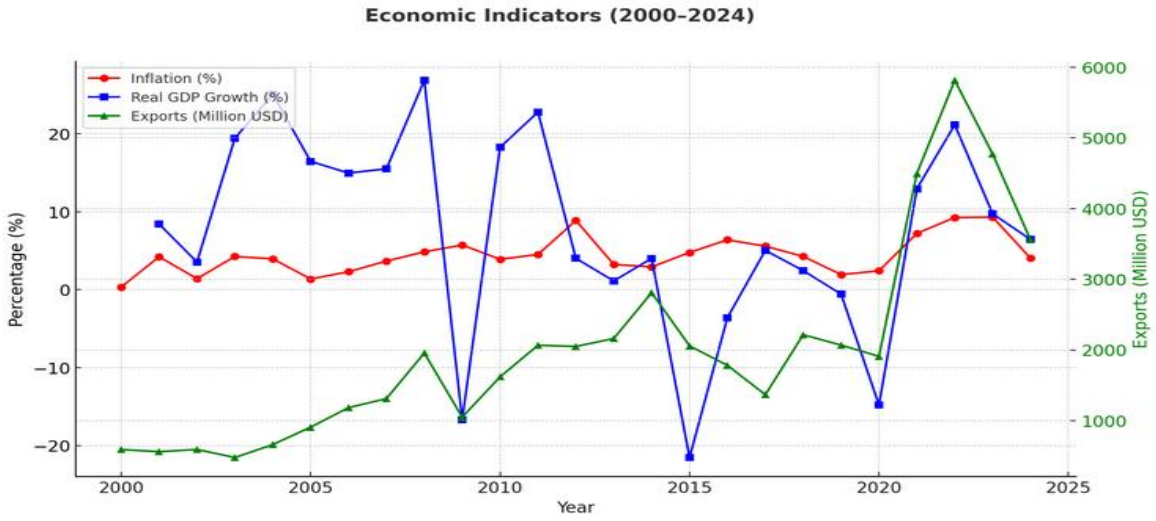
### 3.2.1 Data Collection:

Data for this study are sourced from three primary institutions: The World Bank's World Development Indicators (WDI) database, International Monetary financial (IMF) and the Bank of Algeria. The dataset spans from 2000 to 2024, providing a comprehensive temporal coverage of twenty years to analyze the relationship between Non hydrocarbon exports, GDP per capita and inflation in Algeria.

### 3.2.2 Data Presentation and Visualization:

The graphical visualization of these variables, as shown in figure below, is used to highlight trends and connections during the period between 2000 and 2024.

**Figure N° 4: Key Economic Indicators of Algeria (2000–2024)**




**Source:** Prepared by the researchers based on EVIEWS10 outputs

This graphic confirms:

- Firstly, the high volatility of the NHX. There is a general upward trend, but with sharp peaks and troughs. This suggests that powerful economic factors have influenced exports.
- Afterwards inflation has risen sharply, particularly around 2012, but generally appears to be holding around its average. The question is whether these inflation spikes have had a visible impact on NHX's growth.

- Finally, GDP per capita shows a clear and more consistent upward trend than other variables. Could this sustained economic growth be the main driver of growth in non-hydrocarbon exports?

### 3.3. Analysis:

#### 3.3.1. Descriptive statistics

Table 2 summarizes the descriptive statistics of the two variables used in this study. It presents the number of observations, the mean, the standard deviation (std), the minimum value (min), and the maximum value (max).

**Table N°3: Summary Statistics of Algeria's Key Economic Indicators (2000–2024)**

| Statistic | NHX (Million USD) | Inflation(%) | PIB per capita (USD) |
|---|---|---|---|
| Count | 25.00 | 25.00 | 25.00 |
| Mean | 2001.08 | 4.44 | 4379.16 |
| Std | 1379.15 | 2.39 | 350.23 |
| Min | 477.00 | 0.34 | 3553.30 |
| 25% | 1049.00 | 2.92 | 4279.60 |

| | | | |
|---|---|---|---|
| 50% | 1909.00 | 4.23 | 4456.70 |
| 75% | 2161.00 | 5.59 | 4660.40 |
| Max | 5815.00 | 9.32 | 4768.70 |

**Source**: Prepared by researchers based on python.

For each variable, we have 25 observations ranging from 2000 to 2024. The average value of NHE is USD 2,001.08 million; its minimum value is 477, while the maximum value is 5,815, which experience wide variations but with a high standard deviation of 1,379.15, and sudden increases in 2021-2022. Furthermore, inflation was estimated at an average of 4.44%, which represents a moderate increase in overall prices but with a variability of 2.39% representing the economy experiencing periods of high inflationary pressures. Furthermore, the average GDP per capita of USD 4,379.16 indicates overall economic growth, and the standard deviation of USD 350.23 indicates the saw tooth growth pattern over the 25-year period. All these figures reaffirm the dual nature of the Algerian economy in terms of growth capacity and structural weakness. This is why it is necessary to remain vigilant in the face of internal and external pressures.

### 3.3.2. Correlation Analysis

The graphic below shows the results of the study of the correlation of the variables.

We notice through the correlogram that:

-The correlation between lnNHX and lnGDPpc is strong and positive (0.7912). This is a very strong indication that economic growth is positively related to increases in non-hydrocarbon exports. This supports our **hypothesis $H_{02}$.**

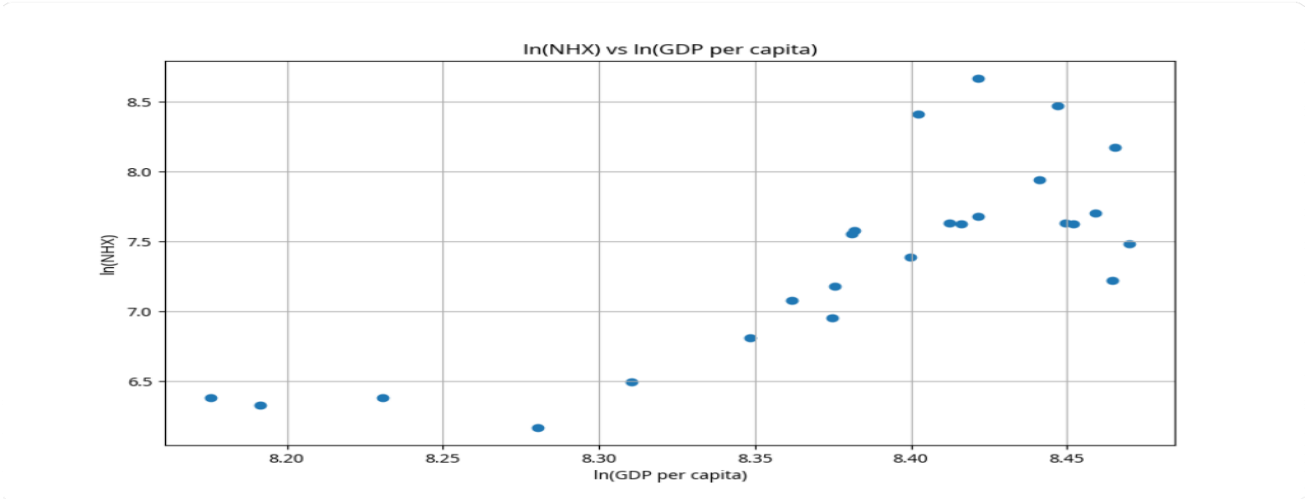
**Table N°4: Correlations (Logarithms)**

| Variable | lnNHX | lnInflation | lnGDPpc |
|---|---|---|---|
| lnNHX | 1.0000 | 0.5447 | 0.7912 |
| lnInflation | 0.5447 | 1.0000 | 0.5791 |
| lnGDPpc | 0.7912 | 0.5791 | 1.0000 |

**Source:** Prepared by researchers based on python

- The correlation between lnNHX and inflation is moderate and positive (0.5447). This suggests that there may be a link, but it is less obvious. Higher inflation sometimes coincides with higher exports, but the relationship is less clear.

**Figure 5: Scatter plot of ln (NHX) as a function of ln (GDP per capita).**




**Source:** Prepared by researchers based on python

This graph shows a clear trend: as GDP per capita (horizontal axis) increases, non-hydrocarbon exports (vertical axis) also tend to increase. The points form an ascending line, which illustrates the strong positive correlation we calculated.

## 4. Results and discussion

### 4.1. Time Series Stationarity Test:

To examine the stationarity of the time series variables in the study model and determine their order of integration, it is necessary to conduct a unit root test. For this purpose, we employed two complementary Stationarity Tests (ADF and KPSS). That is:

•ADF (Augmented Dickey-Fuller) test: Its null hypothesis ($H_0$) is that the series is non-stationary. If the p-value is low (< 0.05), we reject $H_0$ and conclude that the series is stationary.

•KPSS test: Its null hypothesis ($H_0$) is that the series is stationary. If the p-value is low (< 0.05), we reject $H_0$ and conclude that the series is non-stationary.

**Table N° 5: Unit Root Test Results for Stationarity**

| Variable | Test ADF (p-value) | Test KPSS p-value) | |
|---|---|---|---|
| lnNHX | 0.0078 (Stationary) | 0.0187 (Non-Stationary) | Probably Non-Stationary |
| lnInflation | 0.5112 (Non Stationary) | 0.0364 (Non-Stationary) | Non-Stationary |
| lnGDPpc | 0.0248(Stationary) | 0.0231 (Non-Stationary) | Probably Non-Stationary |

**Source:** Prepared by the researchers based on python

From the table above, it is evident that the time series of the model variables are not stationary at the level but become stationary after taking the first difference at all significance levels (1%, 5%, and 10%). Accordingly, for Inflation, both tests agree: the series is non-stationary. For lnNHX and lnGDPpc, the results are contradictory,

which is common with small samples. In this case, prudence and economic theory lead us to consider these series as non-stationary. This means that we cannot rely on a simple OLS regression on the levels. We must check whether there is a long-term relationship (cointegration) between them.

### 4.2OLS Model (Long Term Relationship Analysis)

Based on the results of the unit root test, at this stage, we will estimate the short and long-term relationship according to the OLS Model -Even if the series are non-stationary, they can be "cointegrated," meaning they move together over the long term and do not diverge indefinitely. If they are cointegrated, we can estimate this long-term relationship using an OLS model. The coefficients will then give us an estimate of the long-term impact of inflation and growth on exports.

**Table N° 6**: OLS Regression results

| **Model OLS**<br>**R-squared: 0.637**<br>**Adj. R-squared: 0.604** | | | | | |
|---|---|---|---|---|---|
| **Dep variable lnNHX** | **coef** | **Std err** | **t** | **P>\|t\|** | **(0.025 - 0.975)** |
| **const** | -42.036 | 10.726 | -.919 | 0.001 | -64.281 |
| -19.791 | | | | | |
| **lnInflation** | 0.1253 | 0.152 | 0.826 | 0.417 | -0.189 |
| 0.440 | | | | | |
| **lnGDPpc** 8.559 | 5.8768 | 1.293 | 4.544 | 0.000 | 3.195 |

**Source:** Prepared by the researchers based on python

The table above shows that:

Adjusted $R^2$ is 0.604. This means that our model (with inflation and GDP per capita) explains approximately 60.4% of the variation in non-hydrocarbon exports over the period. This is a good score, indicating that these two variables, particularly GDP, capture a large part of the NHX .

The coefficient of GDP per capita (lnGDPpc) is 5.8768. Using logarithms, this coefficient can be interpreted as an elasticity. Since we use logarithms, this is interpreted as an elasticity. Specifically, a 1% increase in GDP per capita is associated, in the long run, with a 5.88% increase in non-hydrocarbon exports. The p-value is 0.000, which is well below 0.05. This means that this effect is statistically highly significant. This result strongly supports our **hypothesis (H2).**

That said, economic growth is a major driver of non-hydrocarbon exports in Algeria.

The coefficient of inflation is 0.1253. It is positive but the p-value is 0.417 greater than 0.05. The observed effect is statistically insignificant, which confirms our **hypothesis (H1**)Therefore, we cannot conclude that inflation has a real effect on exports.

**4.3 Cointegration Test (Confirmation of Long-Term Relationship)**

This test more formally confirms whether our non-stationary variables are indeed linked by a long-term relationship. If so, our previous OLS model is valid for describing this relationship. Otherwise, it would be misleading.

**Johansen Test Results:**

•Trace Statistics: (33.597, 16.452, 5.667)

• Critical Values (95%): [29.796, 15.494, 3.842]

Using the Johansen test, which compares the "trace statistics" to a "critical value," the following results were obtained:

•For the first hypothesis (no long-term relationship) , the statistic (33.597) is greater than the critical value (29.796). Therefore, we reject this hypothesis.

•For the second hypothesis (at most one relationship) , the statistic (16.452) is greater than the critical value (15.494). Therefore, we also reject this hypothesis.

• For the third hypothesis (at most two relationships), the statistic (5.667) is greater than the critical value (3.842). Thus, there is at least one cointegrating relationship. This confirms our hypothesis H3 and validates our analysis of the long-term relationship. The variables do not derive independently of each other; they are linked by a structural equilibrium.

**4.4 Error Correction Model (Analysis of Short-Term Dynamics(**

Given that a long-term relationship exists, the question that arises is: when a short-term economic shock (such as a crisis) temporarily pushes variables away from their long-term equilibrium, how quickly do they return to it? To answer this question, we use the Error Correction Model (ECM).

**Table N° 7:** Modèle à Correction d'Erreurs

| **Model OLS R-squared:** | | | | | |
|---|---|---|---|---|---|
| **Dep variable lnNHX** | **coef** | **Std err** | **t** | **P>\|t\|** | **(0.025-0.975)** |
| **Const** | 0.0251 | 0.074 | 0.338 | 0.735 | -0.121 |
| -19.791 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **lnInflation** | 0.0440 | 0.083 | 0.532 | 0.595 | -0.118 |
| 0.440 | | | | | |
| **lnGDPpc** 9.405 | 3.4510 | 3.038 | 4.544 | 0.256 | -2.503 |
| **Resid_ lag1 0.015** | | | | | |

**Source:** Prepared by the researcher, based on python outputs

From the table above, the error correction term is statistically significant with the expected negative sign. It is -0.2930. This provides evidence of a long-run equilibrium relationship among the model variables. The value of the error correction term indicates the speed of adjustment of short-run deviations toward long-run equilibrium is 0.2930 which means that approximately 29.3% of the previous year's imbalance is corrected each year. The p-value (0.062) is very close to the 5% threshold, suggesting that this adjustment mechanism is relevant. Additionally, short-term impact (dlnInflation, dlnGDPpc) where the p-values for annual variations in inflation (0.595) and GDP per capita (0.256) are high. This means that, in the short term (year-on-year), shocks to inflation or growth do not have a direct and significant impact on the growth of non-hydrocarbon exports. Short-term dynamics are mainly driven by the return to long-term equilibrium.

5. **Conclusion and recommendations**:

This study highlights the relationships between inflation, GDP per capita and non-hydrocarbon exports, providing actionable information for monetary and economic policies in Algeria for the period 2000-2024:

1. The impact of economic growth is strong and positive in the long run. Our most robust analysis (the cointegrated OLS model) shows that a 1% increase in GDP per capita is associated with a significant 5.88% increase in non-hydrocarbon exports. It indicates that the country's overall economic growth is the main driver for diversifying and expanding non-hydrocarbon exports. Thus, a wealthier and more productive economy is better able to produce competitive goods for the global market.
2. The effect of inflation is statistically insignificant. In either the long or short term, we found no statistical evidence that inflation has a direct impact on non-hydrocarbon exports. However, this relationship advises policymakers to care about inflation monitoring alongside growth policies in order to prevent potential inflationary side effects of economic growth. Although, high inflation could theoretically harm competitiveness, other factors (such as productivity, quality, or the exchange rate) appear to play a much more important role in Algeria over this period.
3. There is a stable long-term equilibrium relationship. The variables do not drift chaotically; they are linked by a restoring force. Even in the event of short-term shocks, the economy tends to adjust so that non-hydrocarbon exports return to a level compatible with the country's economic growth. The adjustment toward equilibrium is gradual and not instantaneous, with

approximately 29% of the imbalance corrected each year. It means that it takes a little over three years for the economy to fully absorb a shock and return to its long-term trend.

4. Using a limited sample (25 observations) and omitted variables, such as the real exchange rate or foreign direct investment, could reduce the power of the tests. Although these variables are considered important factors, substantially explaining external influences, the model still does not take them into account. Indeed, understanding these unexplained factors further improves the predictive accuracy of the model. In addition, it is necessary to point out the possibility of autocorrelation indicated by the Durbin-Watson test of the OLS model (0.647); which can affect the precision of the estimates. To do this, the use of robust standard errors in the ECM model is a good practice to address this problem.

Based on the findings, the below recommendations were developed:

- Improve non-hydrocarbon exports by stimulating non-hydrocarbon sectors (industry, agriculture, services) through special incentives and increased engagement in the regional and international value chain. Reducing the import bill and relying on local products
- Rationalize public spending not only by adopting a targeted fiscal policy but also by directing it towards investment and/or production spending.
- Adopt sustainable growth strategies by promoting infrastructure, education and innovation that enable long-term growth while reducing dependence on hydrocarbons. It is therefore wiser to diversify revenues and not rely solely on oil taxes.
- Implement an inflation control policy that restricts monetary and budgetary discipline in order to stabilize prices, improve domestic production and thus reduce its dependence on imports.
- Financing industrial modernization and digitalization to increase productivity and competitiveness. At the same time, traditional financing, which leads to high import costs, must be reduced.

Strengthening political stability and governance by improving institutions and the quality of transparency while removing bureaucratic barriers. This will inevitably contribute to attracting foreign and domestic investment.

In summary, this econometric study quantified the relationships between economic growth, inflation, and non-hydrocarbon exports in Algeria. As we have observed, the main result is unequivocal: economic growth is the main determinant of the long-term success of non-hydrocarbon exports. Inflation, within the limits observed over the period 2000-2024, does not appear to be a direct factor. The existence of a cointegration relationship and an error correction mechanism confirms that the economy exhibits stable, albeit gradual, adjustment dynamics. In the future, the diversification of Algerian exports will therefore depend mainly on its ability to generate strong and sustainable economic growth.

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