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Comparative impact of oil and petroleum exports on economic growth: A standard study of Algeria's economy

Si Mohammed Fatiha

Phd Student, Agricultural and Tourism Sector Strategy Laboratory, Department of Economics Commercial and Management Sciences, University of Ain Temouchent, Algeria

Orcid: <https://orcid.org/0009-0007-4151-6977>


Abstract--This study seeks to compare the impact of oil and petroleum sales on Algeria's economic growth. This is using an economic model with annual data determined from 1990 to 2023, we have revealed significant insights. The model employs oil and petroleum exports as independent variables and economic growth as the dependent variable. Components constituting the model: The Vector error correction model data showed that the variables in the model were in long-term equilibrium. Additionally, the test results of Impulse Response Functions and analysis of variance decomposition substantiated the statistically significant influence of oil exports on economic growth. This confirms Algeria's inability to reduce dependence on oil. The economic importance of oil exports, which offer social security, is still significant. Although the Algerian Government had made significant efforts to provide facilities for those seeking to invest in productive sectors, it still needed funding, greater support, and permanent escort to shape Algeria's economic future.

Keywords---Energie pétrolière, Oil, GDP, Cointegrated Vector Autoregressive Model, Algeria

Jel Classification: P28, F43, O11

1. Introduction

Energy is of significant economic importance. It serves a crucial function in managing the economic cycle and providing well-being in all countries of the world, as modern technological development depends on it. This underscores the potential for significant economic growth in the future. In order to facilitate labour

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Corresponding author: Fatiha, S. M., Email: fatiha.simohammed@univ-temouchent.edu.dz

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and offer the required capacity to improve development and social well-being, the most important question that needs to be answered will continue to be how much energy the economy requires from the collectors throughout the world. (Kurt) Oil is a crucial economic asset in advancing and growing a nation's economy as it serves as a primary conduit for fiscal and monetary revenues, which are utilised to fund the country's general budget. Its surpluses play a pivotal role in fostering the advancement of a nation's economic standing and in enhancing financial performance. Additionally, oil revenues have a significant impact on macroeconomic indicators such as economic growth, inflation, employment, and foreign trade. (Hamdaoui & Cancelo, 2024) Oil policy is crucial and effective in growing the world's economy. It has impacted the production of electricity or oil extracts, such as gasoline and diesel, which are essential for transport of various kinds, and the production of fuel, which is dependent on some manufacturing industries. The economies of different nations worldwide have been disrupted due to the decline in oil production in 1973 (Rig Offshore , 2024). In response to possible future petroleum crises, European countries and Japan took several decisions, including diversifying energy imports such as coal, which is expensive to extract (Ben , Nakano, & Irié, 2024). There is a link between oil supplies and economic diversification, and many economists have tried to find ways to make money by investing in renewable energy sources. The source curse' hypothesis is one of the most significant economic theories associated with oil, which implies that various oil countries are overly dependent on the revenues generated by their peers, resulting in them not investing in the economic, social, and renewable energy sectors, even if oil prices continue to rise. (International & External, 2017) According to the resource curse theory, countries should diversify their economies and invest in renewable energy to prevent adverse effects from relying excessively on non-renewable resources, like oil, gas, and mineral wealth. Three fundamental inquiries regarding the influence of resource rents on economic performance are the availability of resources and the magnitude of reserves, the intensity of exports, and the methodologies for quantifying income levels, growth rates, or development indices. (Amadou, Arezki, & Thorvaldur , 19 Jan 2012) .Despite progress in some countries, the dominance of the oil sector still means that economic diversification remains fairly low in all Arab oil-exporting countries (Manama, 2016). Economists have also questioned whether natural resources benefit or harm a country's economy. The economic vision and policies are focused on utilising natural resources and creating a more diverse and resilient economy to handle shocks and oil price volatility. Numerous countries are striving to increase their non-oil exports in a cumulative manner that surpasses oil exports or contributes to GDP financed by oil sector revenues. The export structure serves as an alternative to tradable output and a significant source of productivity enhancements for sustainable growth, as numerous countries aim to augment their non-oil exports cumulatively, surpassing oil exports or contributing to GDP financed by oil sector revenues. The diversity of gross domestic product and non-oil growth are deceptive indications of true diversification and sustainable growth, as evidenced by Bahrain, which demonstrates that a highly varied output does not inherently imply diversification of exports. (Cherif, Hasanov, & Zhu, 15 Apr 2016). The economy is dependent on sustainable resources that promote sustained development and diversification. The economy depends on sustainable resources that foster economic diversification and sustainable development, providing a framework for economic growth, social

justice, environmental stewardship, and governance by reducing reliance on singular, lucrative sectors as a pivotal strategy for enhancing economic opportunities. (Iftikhar, SEPTEMBER 2023)

Algeria, a key player in the global oil industry, stands out among developing countries with its significant petroleum resources. It holds a prominent position in the African, Arab, and international oil markets. The country's oil sector, a major contributor to national income, plays a crucial role in shaping Algeria's economic landscape through its substantial fiscal and financial revenues from exports, typically denominated in hard currency. Algeria's economic activity is primarily powered by oil, complemented by investment and income, which keep it at the forefront of the worldwide market. In 2009, Algeria was positioned ninth in oil income among OPEC member nations and was the seventh-largest global producer of natural gas. Algeria is an oil exporter. Several sources from OPEC and the Joint Organizations Data Initiative (JODI) say that Nigeria will be one of the ten biggest oil producers in Africa in 2023, followed by Egypt, Algeria and Libya and ranked tenth worldwide and in the top position in Africa for natural gas production. Its production share increased by 4% to 101.5 billion cubic metres in 2023 from about 97.6 billion cubic metres in 2022. Algeria has been entirely dependent on oil's economic grace since the early 1970s, emphasising the growth of production and revenues despite volatile oil prices and global economic and geopolitical events. Algeria's oil riches are extremely significant since they generate the financial surpluses needed to fund goals for social and economic growth. It is also possible to assert that oil has had a substantial impact on the nature of development in both producing and importing countries from its discovery to the present day. The study emphasises the significant impact of the petroleum industry on the Algerian economy. This article aims to determine how much oil exports support Algerian economic development. Notwithstanding its endeavours, it has failed to assimilate effectively into the worldwide economy. This is due to the country's significant dependence on imports, restricted non-hydrocarbon exports, and insufficient foreign direct investment (FDI) (Kadi, April 2020)

This paper employs a robust methodology, utilising a range of statistical techniques and econometric models, including Johansen's integration test. It will then present a comprehensive analysis of Algeria's export trends in petroleum products and crude oil.

2. Review of Literature

To pursue this paper's objective, we begin by reviewing studies on how non-oil exports impact economic growth, as well as economic models that analyse the connection between oil revenues and economic growth, and explore the roles that oil and non-oil incomes play in the economic growth of oil-exporting countries. The examination of the influence of non-oil exports on the economic growth conducted by researchers (ONODUGO, Jun 2013) is based on the application of a standard model to the Nigerian economy. Based on traditional bounce-back and co-integration tests and the enhanced production function (APF). The internal growth model (EGM)

was used from 1981 to 2012. In contrast with the findings of theoretical studies, which posit that non-oil structures form the bedrock of the Nigerian economy, the results of the standard survey signified that non-petroleum exports in Nigeria exert a relatively weak contribution to economic growth. To determine the impact of hydrocarbons and non-petroleum goods on Iran's economic growth, researchers (Hosseini, 2014) employed a standard economic model during the annual data period between 1970 and 2008., and the findings showed a sustained correlation between the study variables and the negative impact of oil exports on economic growth. The study stated that non-oil exports in Iran needed to be encouraged to boost sustained economic expansion. Researchers (Khayati, 2019) recommended the need to liberalise oil dependence in the short term in order to achieve the objective of promoting economic diversification. The results of the econometric study adopted on Bahrain's economy from 1977 to 2015 showed a long cointegration of the independent variable and both hydrocarbons and non-oil exports. In addition to the significant correlation between oil exports and economic growth. To investigate the relationship between oil revenues and economic growth in Nigeria, both (Nweze & Greg, 2016) used an economic model spanning 1981 to 2014 and focussing on economic growth and crude internal output. The main source of interpretative variables, such as oil revenues (OREV) and government expenditures (GEXP), was CBN publications. The study used many advanced standard economic techniques such as the Dickey-Fuller Enhanced (ECM), the unit root, and the Johansen cointegration test for the data. The outcomes indicated that the factors were in long-term equilibrium, and the ECM estimate confirmed that every single variable except for government spending determines the rate of economic growth in Nigeria, except for government spending. According to the study, investing oil in other local sectors like agriculture and industry is necessary to expand the economy's revenue sources and increase its revenue base. The study (Ogunbiyi & Abina, 2019) also aims to investigate the roles played by oil and non-oil income to Nigeria's economic development by employing a standard model that incorporates both revenue streams and the Human Development Index (HDI) as independent variables from 1981 to 2018. Diverse examinations were utilised as a fundamental assessment of Dickie Fuller's enhanced unit root, Johannesen integration, and error repair estimations. The typical analysis indicates that oil revenues exhibit a negative association. Using the indicator of human development, non-oil income demonstrates a positive, albeit negligible, link. The report emphasised the necessity of diversifying exportable items and enhancing efforts to mitigate the illicit export of crude oil. With regard to the Nigerian economy, researchers (Adegbola, et al., 2023) analysed the impact of oil and non-oil tax revenues on both petroleum profits' tax, corporate income, value added tax, and customs tax on economic growth. The study adopted a standard error

correction model study where data were obtained from the annual reports of the Central Bank of Nigeria publications and the Federal Internal Revenue Services. Previous studies have confirmed a significant direct (positive) correlation between the level of economic growth (the approved variable), oil profit tax, custom tax, and production duties and a significant negative correlation between economic growth (the approved variable), VAT, and corporate income tax. The rise in taxes, tariffs, and excise on oil profits increases the level of economic growth. The study suggested that efforts should be made to diversify the economy rather than concentrating solely on the oil industry. Use tax revenues, in particular oil dividend tax, custom tax, and production fees, to build the local economy, specifically in the agro-allied industry and the manufacturing sector.

3. The Role of Energy in Algeria's Economic Development

Algeria's energy strategy was formulated through extensive reforms aimed at incorporating environmental factors into the policy framework while enhancing the nation's macroeconomic indicators and the quality of human development. Energy infrastructure can promote economic growth and development in various ways. Electricity serves as a crucial production element for enterprises, as research indicates that its substitutability by alternative production factors is constrained; thus, its absence may result in production limitations. (International Monetary Fund. , 2024) Energy also facilitates funding for the health and education sectors, as well as significant infrastructure projects. Examples include road projects, bridges, and airports, alongside the expansion of the Hodeidah railway network and support for social development through housing initiatives initiated by the Algerian Government, while also considering their influence on macroeconomic variables, such as the enhancement of foreign exchange reserves from oil exports that contribute to mitigating inflation in Algeria. The graph illustrates that the volume of crude oil and petroleum exported from Algeria remained relatively consistent between the years 1990 and 2000. By the year 2000, the value of oil exports had increased gradually, reaching its peak in 2007

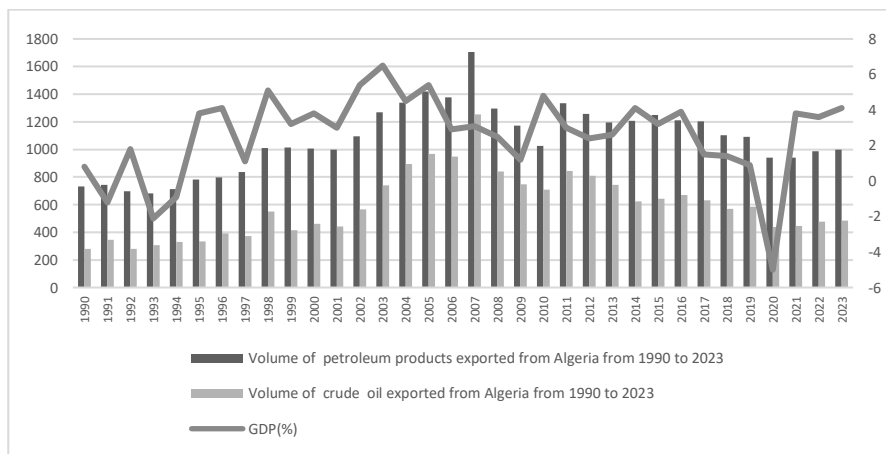


Figure 01: Volume of oil and petroleum products exported from Algeria
Source: <https://www.statista.com/>

This was a period of growth in global demand for various energy sources, with total world oil exports reaching a record of 1253.5 million LEF/J and petroleum exports estimated at 1704.8 million dollars. (IEA, 2024). The State's public revenues are significantly influenced by petroleum collection. Owing to the substantial drop in the price of oil that occurred in the year 2008, the revenues received increased, with the greatest increase estimated at 78.77%. Furthermore, the State's public budget is almost entirely funded by these revenues, which provide the Government with the requisite financial resources to fund development initiatives and allocate funds to a variety of economic sectors. (Kenan , 2015). Mid-2014 saw a sharp decline in oil prices, dropping from \$80-110 per barrel in 2011-2013 to \$40-60 for most of 2015-2017. The national economy was supported by an increase in exports and a \$200 billion increase in foreign exchange reserves (Group, 2018). In 2017, the oil levy's proportion of public revenues decreased to approximately 38.4% as a result of the low prices of crude in global markets. Conversely, Algeria's exports of petroleum and crude oil gradually declined, with the value of crude oil reaching a minimum of 477 dollars in 2022. (word bank, 2016) .The economy depends on sustainable resources that foster economic diversification and sustainable development, providing a framework for economic growth, social justice, environmental stewardship, and governance by reducing reliance on singular, profitable sectors as a pivotal strategy for enhancing economic opportunities (Alby, 2024)

4. Model Estimation and Methodology

All economic operations rely on energy, especially petroleum, which is primarily used as a fuel for various land, marine, and air vehicles. Oil is also used to generate electricity, run factories, and operate heavy machinery. Oil, petroleum, and various energy sources constitute over 90% of Algeria's total exports and government revenues, significantly influencing economic growth. This is particularly evident as Algeria depends on the importation of intermediate goods, consumer products, and new technologies while simultaneously grappling with the underdevelopment of both agriculture and industry, which adversely affects the nation's economic progress. In this framework, a model may be constructed to

evaluate the correlation between oil and petroleum exports and the economic growth of Algeria. The proposed model is as follows:

$$GDP = f(\text{Crude-EXP}, \text{Petro-EXP})$$

has been tested so that the formal linear model can be developed as below.

$$GDP = B1 * \text{Crude-EXP} + B2 * \text{Petro-EXP} + U_t \dots (1)$$

Where:

GDP refers to growth (% annually)

Crude-EXP: The volume of crude oil exported from Algeria

Petro-EXP: The volume of petroleum products exported from Algeria

The data utilised in this study were sourced from the Research department and the philosophy of its content in Algeria and the International Monetary Fund, covering the period from 1990 to 2023. The unit root and degree of cointegration for all variables are established through the application of advanced Dickey-Fuller tests and Phillips-Perron tests. Johansen's cointegration method was utilized to assess the long-term equilibrium relationship, followed by the application of the vector error correction model (VECM) to elucidate the causal connections between employment and various other variables.

5. Empirical Results and Conclusions

▪ Unit roots test and Cointegration Analysis :

This study used tests for data stabilisation. The examination results are displayed in Table 1 below to determine the presence of a unit root in the time series. The results of the econometric study (table1) indicated that considering the null hypothesis might be worthwhile, given that statistical values are lower than critical values (Régis & virginie , 2022). Furthermore, after applying the first differences, the time series became constant, which is integrated into I (1). Johansen's cointegration test results, as shown in Table 2, confirm the rejection of the null hypothesis and acceptance of the alternative hypothesis as the λ probability statistic is greater than its critical values at a 5% significance level, which confirms a cointegration relationship between the variables.

Table 01: Unit roots test

variables	Aug -DickFllle TEST		Phil-Perron TEST	
	Level	The first différence	level	The first différence
GDP	0.1971	0.0000	0.7571	0.0008
Crude-EXP	0.5458	0.0000	0.5716	0.000
Petro-EXP	0.6570	0.0000	0.6570	0.0000

(*notes significant at 1 %, ** notes significant at 5 %, **** notes significant at 10 %)

Source: Author's Estimate made with Eviews 10

Table 02: Cointegration Analysis

The rectified sample: 1992–2023.
 Included observations: 32 after adjustments
 Series: GDP CRUDE_EXP PETRO_EXP
 Intervals of lag (initial differences): 1 to 1
 Unrestricti Coint Test of Rank (Trace)

Hypothesis	Eigen-value	Trace	0.05	
No. of C(s)		Statis	Criti Value	Probab.**
None *	0.480905	30.16917	29.79707	0.0453
At most 1	0.165551	9.187796	15.49471	0.3483
At most 2	0.100697	3.396322	3.841466	0.0653

The trace test reveals one cointegrating equation at the 0.05 significance level.

Source: Author's Estimate Made with Eviews 10

▪ Long-run estimates

The results of the estimation of the vector error-correcting model (table) show a positive short-term and long-term relationship between petroleum exports and economic growth, as opposed to oil exports that have a negative impact, which is not commensurate with the economic theory of Algeria as an oil nation. However, this finding is different from most previous studies applied to oil states and is somewhat in line with (Sultan & Imdadul Haque, 2018), which confirmed a long-term positive relationship between oil export revenues and Saudi Arabia's economic growth. The volume of petroleum exports is related to its prices on the stock markets. The volume of both petroleum and oil exports has seen a significant decrease since 2006 (figure above). This is consistent with the price decline that reached US \$60 per barrel in early 2007 following the record increase of US \$75 in mid-2006. Throughout the first half of 2008, oil prices rose consistently, reaching US \$141.71 per barrel, which corresponded with a rise in Algeria's oil and petroleum exports. Algeria experienced a higher increase in petroleum exports than oil exports in 2022 and 2023.

Table 03: Long-run estimates

VECM
SM-ADJ : 1992 2023
Includes- observatis: 32 after adjustments
Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1		
GDP(-1)	1.000000		
CRUDE_EXP(-1)	0.003036 (0.00501) [0.60562]		
PETRO_EXP(-1)	-0.007623 (0.00482) [-1.58067]		
C	3.820739		
Error Correction:	D(GDP)	D(CRUDE_E XP)	D(PETRO_E XP)
CointEq1	-0.593251 (0.29632) [-2.00205]	41.36500 (13.7120) [3.01669]	42.27471 (14.5216) [2.91116]
D(GDP(-1))	-0.117233 (0.22401) [-0.52334]	-21.56006 (10.3658) [-2.07992]	-16.44518 (10.9779) [-1.49803]
D(CRUDE_EXP(-1))	-0.001807 (0.00776) [-0.23277]	-0.139997 (0.35914) [-0.38982]	0.217309 (0.38034) [0.57136]
D(PETRO_EXP(-1))	0.001398 (0.00720) [0.19427]	-0.149288 (0.33302) [-0.44828]	-0.482979 (0.35268) [-1.36944]
C	0.175935 (0.43323) [0.40610]	8.246053 (20.0475) [0.41133]	11.83336 (21.2312) [0.55736]
R-squared	0.315381	0.276007	0.293013
Adjust. R-squared	0.213955	0.168749	0.188275
The sum of sq. residues	161.1541	345078.3	387029.8
S.E. equal	2.443086	113.0517	119.7265
Fisher-statisti	3.109492	2.573295	2.797564
Log likelihood	-71.27203	-193.9787	-195.8144

Akaike info criteria	4.767002	12.43617	12.55090
Schwarz	4.996023	12.66519	12.77992
Mean dependnt Standar.Devia. dependent	0.165625	4.321875	7.915625
	2.755594	123.9969	132.8880
<hr/>			
Deterdoinant resid covariance (of adj.)		1.93E+08	
Determinant resid covarice		1.16E+08	
Log likelihood		-433.3171	
Akaike information criterion		28.20732	
Schwarz criterion		29.03179	

Source: Author's Estimate Made with Eviews 10

The estimate model's findings show that the error correction parameter is negative and statistically significant at the 5% level, which confirms the validity of the error correction model. The speed of adjustment is (-0.593251), which indicates that the dependent variable takes (1/0.593251) more than one year to reach its long-term equilibrium value when any shock occurs in one of its determinants. The remaining ratio is the result of other variables that should have been included in the model. Additionally, the value of the R-squared was estimated at 0.3153, indicating that 31.53%. The fluctuation in the dependent variable can be traced to the independent factors. The remaining ratio represents the influence of other variables that were not included in The model.

▪ **Dynamic Equations:**

Our analysis of variance decomposition and impulse response seeks to ascertain the model's dynamism throughout various periods by emphasizing the comparative influence and relative significance of oil and petroleum export rates on Algeria's economic growth in the medium and long run. The analysis of variance decomposition (Table 2) confirms the proportionality of both oil and petroleum exports in the analysis of economic growth variation where during all study periods. Throughout the study period, Algeria's economy experienced periods of prominence and obscurity, which coincided with the ups and downs in energy export development that countries require to adapt to global energy trends and facilitate the movement of their diverse economic activities. Algeria's proven crude oil reserves were estimated at 12.2 billion barrels as of early 2023. The country is known for its production of high-quality, light, and sweet crude oil with a very low carbon content, especially the desert blend from the Hasi Masood field. Algeria is experiencing challenges in attracting new investments for its ancient oil fields despite the presence of these high-quality reserves. This has resulted in challenges in maintaining production levels. Algeria's crude oil and condensate exports are 0.7% higher than in the first quarter of 2022, at 427.83 barrels per day, or the equivalent of more than 3 thousand barrels per day. (International -U. , 2024) The economic growth response to oil and petroleum shocks is positive throughout the study (figure 2), and it gradually proportionates to 0.23 in the tenth period, as confirmed by the push response results. This shows the important role that energy plays in the Algerian economy.

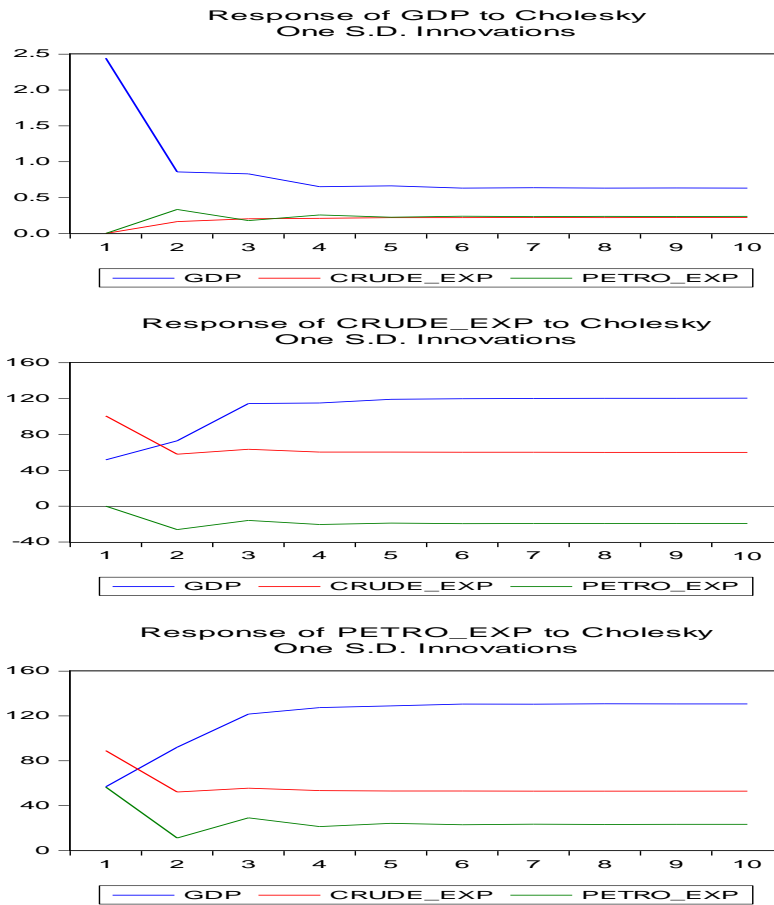


Figure 02: Impulse Responses
 Source: Author's Estimate Made with Eviews 10

Table 04 : The VD analysis

Duration	standard deviation.	GDP	CRUDE_EXP	PETRO_EXP
1	2.443086	100.0000	0.000000	0.000000
2	2.615889	97.97206	0.391611	1.636328
3	2.757862	97.20949	0.902835	1.887672
4	2.853097	96.04041	1.383954	2.575640
5	2.945694	95.14003	1.856765	3.003202
6	3.029997	94.25771	2.275937	3.466353
7	3.112789	93.48974	2.659537	3.850728
8	3.192512	92.78407	3.004480	4.211448
9	3.270508	92.14910	3.318144	4.532757
10	3.346527	91.56884	3.603459	4.827705

Source: Author's Estimate Made with Eviews 10

3.4. Residual Diagnostics:

The model is statistically acceptable according to diagnostic tests. Table 4 shows that there is no correlation between errors, as indicated by the Breusch-Godfrey serial correlation test results. We reject the null hypothesis where the statistical probability value χ^2 exceeds 0.05. The null hypothesis must be accepted when the statistical probability is greater than 5% according to the heterogeneity test in Table 5

Table 05: LM test for serial correlation

LM Tests for the VEC Resid Ser Corr Variab
 Null Hypothesis: absence of serial correlate at lag order h
 Sample: 1990 2023
 Observations include: 32

Lag times	Line Mod-Sl	Probab
1	3.369826	0.9478

Source: Author's Estimate Made with Eviews 10

Table 06: Heteroskedasticity test

Residual Heteroskedasticity Tests: (just levels and squares)
 Sample: 1990 2023
 Observations include:: 32

Joint test:

Chi-squared	df	Probab.
47.33374	48	0.5001

Source: Author's Estimate Made with Eviews 10

4. Conclusion

This article analyses the comparative effects of oil and petroleum exports on Algeria's economy in relation to economic growth. The standard investigation revealed a long-term correlation between the variables, while the variance decomposition analysis and impulse response tests indicated a comparable impact in both the short and long term, aligning with the economic theory pertaining to Algeria as an oil-dependent state and its independent factors. The Model Vector Correction Model indicates a negative effect on oil exports compared to petroleum. Given the necessity of importing nations for this commodity and the impact of oil price volatility on the nation's financial and economic stability, it is imperative for the Government to pursue economic diversification away from oil dependence.

Recommendation

The study suggests separating the total dependence on oil revenues as a resource to cover various expenditures, the necessity for economic diversification in Algeria by promoting multiple agricultural and industrial economic sectors, and the need to encourage innovation and contracting among university students through the opening of private institutions. These development projects require financial support that includes financing at very low interest rates, tribal and subsidised training, and escort.

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