



Oil Price Fluctuations and Economic Vulnerability: Challenges for Algeria's Resilience and Diversification

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Abstract :

The Algerian economy experienced multiple oil cycles characterized by periods of growth, crisis, and partial recovery during the period 1990-2023. While recent economic growth, particularly in the hydrocarbon sector, reflects Algeria's resilience, the country remains highly susceptible to external factors, especially global oil price fluctuations. This study analyzes the impact of these fluctuations on Algeria's economic performance using the Vector Error Correction Model (VECM). The model explores the intricate relationships between oil prices—measured by the OPEC basket reference—and four key macroeconomic variables: GDP growth rate, DZD/USD exchange rate, Consumer Price Index (CPI), and budget expenditures. Findings reveal that Algeria's economy is particularly vulnerable to oil price changes, significantly affecting the CPI, exchange rate, and government spending. To enhance its resilience against oil shocks, Algeria must prioritize economic diversification and implement macroeconomic stabilization measures.

Key Words: Oil prices, oil shocks, Algerian economy, VECM, economic diversification

JEL Classification : Q43, O11; C32

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Introduction:

The link between oil price fluctuations and economic growth in Algeria is studied through a wide spectrum of econometric approaches, repeatedly highlighting the profound influence of oil market dynamics on the country's macroeconomic performance. A majority of studies use vector autoregressive models (VARs) to elucidate this relationship, Benramdane (2017) and Benbouziane et al. (2022) manage to demonstrate Algeria's hypersensitivity to the volatility of world oil prices. Benramdane's findings suggest that the adverse effects of oil price volatility on growth neutralize the supposed profits of the oil boom, revealing the paradox of the "resource curse" in the Algerian context. This vulnerability is corroborated by Bensafra (2022), which depicts the asymmetric impact of oil shocks on various sectors of the Algerian economy. The hydrocarbon sector's rapid response to price shocks (within 1-2 quarters) in the face of the delayed effect on other sectors (5-7 quarters) provides insight into the pervasive but disparate influence of oil price fluctuations. Complementing these results, Guechari (2018) and Dahmani et al.



(2022) use non-linear models to capture the nuanced and asymmetric nature of oil price effects. Their research suggests overall that while the direct impact of oil shocks on macroeconomic variables may be relatively limited, the economy shows increased sensitivity to positive oil shocks, manifesting itself in both short-term volatility and long-term growth patterns. Laourari and Gasmi (2016), using Johansen's multivariate cointegration approach, discover a long-term negative impact of unexpected changes in oil revenues on Algeria's economic and industrial growth. Olayungbo and Umechukwu (2022) use a global vector autoregression model, which highlights the asymmetric effects of oil price shocks on African oil-exporting nations, with Algeria showing a particularly pronounced sensitivity to positive price shocks. The heterogeneity of responses among oil-exporting economies is further accentuated by Berument and Ceylon (2010) as well as Monesa and Qazi (2013), whose comparative analyses highlight the idiosyncratic nature of Algeria's oil price-growth dynamics in the OPEC and MENA contexts. Abdelsalam's panel quantile regression approach (2023) offers additional granularity, delineating the dichotomous effects of oil price changes and volatility on oil exporting and importing countries in the MENA region, with Algeria's growth positively correlated with price increases but negatively impacted by volatility. The literature also provides insights into the transmission mechanisms and policy implications of oil price fluctuations in Algeria. Amroun and Smaali (2022) and Lacheheb and Sirag (2019) examine the inflationary consequences of oil shocks, revealing asymmetric transmission effects that require nuanced policy responses. Chelghoum, Boumimmez and Alsamara (2023) clarify the role of money demand as a channel for oil price shocks, highlighting the imperative of calibrating monetary policy in light of asymmetric dynamics between oil prices and money demand. Sadeghi (2017) and Rotimi and Ngalawa (2017) emphasize the importance of fiscal policy and size of government in modulating the economy's response to oil price shocks, while Bouchaour and Al-Zeaud (2012) offer a long-term perspective on the multifaceted impacts of oil price distortions on various macroeconomic indicators. Collectively, these studies highlight the crucial need for economic diversification, as articulated by Moawad Ahmed (2016), to mitigate Algeria's vulnerability to oil price volatility and achieve sustainable economic growth. More recently, Hadji and Ben Abderrahmane (2024) examine the effect of oil price fluctuations on economic growth in Algeria from 1973 to 2023, using the Autoregressive Distributed Lag (ARDL) model and the Zivot-Andrews Structural Breakdown Test (ZA). The results show that oil price increases are holding back economic growth by increasing production costs and reducing the competitiveness of non-oil sectors.

The consensus that emerges from this body of research is clear: Algeria's high dependence on hydrocarbon revenues generates significant macroeconomic instability, requiring a comprehensive strategy of economic diversification and sound fiscal and monetary policies, to ensure sufficient resilience, in the face of fluctuations in global oil markets.

The objective of our work is to analyze the transmission mechanisms and the impacts of oil prices on the Algerian economy



In order to answer our problem and verify our hypotheses, we have divided our study into four sections. Thus following this introductory section, The second will focus on the Resource Curse and the Issue of Rent. The third section will expose Economic Policies & Hydrocarbons Sector in Algeria (1990-2023). The Fourth Section will discuss the will recall the characteristics of the Algerian economy and its dependence on hydrocarbons, and will show, using the VECM model, the impact of oil price variation on macroeconomic indicators in Algeria (GDP growth rate, consumer price index, exchange rate and budget expenditure).

I. The Resource Curse and Rent – Implications and Concepts Adopted for Algeria

1. The Resource Curse

At the end of the 19th century, the economic paradigm linked abundance of natural resources and economic development. Advanced countries, richly endowed with natural resources, such as Great Britain, the United States, Canada or Australia, are experiencing an industrial boom. Since the 1960s, the rule is no longer applicable, with the appearance of proven cases of failed experiments, many richly endowed countries.

The work undertaken in the analysis of the natural resource curse hypothesis, claims that developing countries, rich in natural resources – including hydrocarbons – tend to have lower levels of economic and social performance and growth rates than other poor countries. She cites as an example the many school cases from African, Middle Eastern or Latin American countries, with abundant resources, but weaker economic performance, compared to those of countries less well endowed with resources, such as those of Southeast Asia: Japan, Singapore, Taiwan, South Korea or Hong Kong. The concept of the curse of natural resources in traditional literature, evokes a negative correlation between natural resource endowment and economic and social development. (AUTY, 1993) defines the natural resource curse, or paradox of abundance, as the perverse effects of a country's natural resource wealth on its economic, social, or political well-being. The works of (SACHS and WARNER, 1995, 1997a, 1997b, 1999, 2001), remain the most cited references in this area. They demonstrate a negative correlation between natural resources and economic growth through the relationship that links the share of raw material exports in GDP and economic growth recorded for economies in the period between 1970 and 1989.

Chronologically, the term Dutch Disease was first used by The Economist in 1977. The first theory goes back to North and Thomas (1973). The latter proposed a pioneering analytical framework for the notion of the rentier state. For a review of the literature on the resource curse, see in particular (Ross, 1999, 2015),

Also (Rosser, 2006), (Humphreys et al., 2007),

More recent literature (LEONG and MOHADDES, 2011), (CAVALCANTI, MOHADDES and RAISSI, 2012), and (MOHADDES and PESARAN, 2013), opposes the previous formulations of traditional literature, and rather defends the



study of the entrainment of the phenomenon of the curse of resources by the great volatility of the prices of natural resources, in particular those of oil.

In the context of Algeria, work has been done around the concept of Dutch syndrome or more generally the curse of resources: (Jbirand Zouari-Ghorbel, 2011), (Chekouri, Chibi and Benbouziane, 2013, 2017), (Boussalem and Benterki, 2015), (Gasmi and Laourari, 2017)

2. The Rent

Recent publications, in the human and social sciences, concerning Algeria, reflect the centrality of the concept of rent, the rent of hydrocarbons in this case. It systematically refers to the theory of the Rentier State (Beblawi, 1990). It is necessary to determine the circumstances and reasons that allowed this rent to become so important, infiltrating all the economic, social and political gears, to the point of relegating other forms of production to the background.

The rentier state in theory, assimilates the rent – in this case the oil rent – to an external income. This theory is based on at least two theoretical currents of rent (Talahite, 2012): the classical (Ricardo or Marx), on the one hand, and the *Public Choice*, on the other. Another theoretical model is the "Dutch disease", which examines the rentier effects of hydrocarbons on the economy. This is an external income dependent on non-national factors.

According to Algerian legislation in this area, the revenues that the country derives from the export of hydrocarbons are shared between the State and the national company SONATRACH. In 2023, hydrocarbon revenues accounted for some 52% of budget revenues and up to 48% of budget expenditure financing (BA, 2024). The redistribution of this income by the State, passes through public expenditure in the form of transfers: 48% financing of budgetary expenditure, in 2023 (BA, 2024). Redistribution (prices, administered, subsidies, allowances, etc.) can cause unnatural rents and market distortions leading to "rentseeking"

According to the theory of "rentseeking", rents that result from the intervention of the State and institutions, have the effect of reducing production, according to (Bhagwati, 1996). Profit-seeking can result in a direct loss to national income, either through specific activities or indirectly through an increase in profit rates in rentier sectors, thereby attracting capital at the expense of other sectors and reducing total production. It is not hydrocarbon revenues that cause these effects, but the intervention of the State and institutions in the economy. This energy rent compensates for the drop in production caused by rent-seeking and allows the State to finance the deficits resulting from its interventionism. Rent-seeking can proliferate even in the absence of rent, as Algeria showed in the 1990s: hydrocarbons are decreasing, but rent-seeking activity is not weakening, and paradoxically, it is becoming widespread (Dillman, 2000). The same phenomenon has been observed since 2001, with the freezing of part of hydrocarbon revenues in the Revenue Regulation Fund (FFR) (Talahite and Hamadache, 2011).

Originally, the theory of "Dutch disease" was designed to explain the relationship between inflation and the exchange rate in small open economies developed without



state control, such as the Netherlands, from which it takes its name. These savings are subject to the effects of a permanent windfall, like hydrocarbons in the case of the Netherlands. According to the version of the "Dutch Disease" theory proposed by Bevan, Collier and Gunning (1990), adapted to the small open economies of developing countries under state control, such as Algeria, the latter, until the end of the 1980s, followed the so-called "incompatible" model which recommended price liberalization in stages. The application of the Dutch Disease model can also be extended to the economic history of development (Williamson, 2011).

We can then stipulate that a rentier economy is an economy in which the existence of significant external income, not linked to production, gives rise to "rentier" behaviours unfavourable to the productive orientation. The national political and economic challenge is the control of rent and its circulation. In such an economy, few people are engaged in the wealth of this Rent, the majority are only involved in its distribution or use.

The socio-economic characteristics of oil-rich states (and by extension hydrocarbons) as well as the elements constituting an obstacle to the development of an economy dependent on natural resources, are applicable to Algeria.

II. Economic Policies & Hydrocarbons Sector in Algeria (1990-2023)

1. Oil Sectors developments in Algeria

From its independence, Algeria – through the mobilization of the nation's vital forces (coalitions and ruling elites) – began to lay the foundations of a strategy for the recovery and development of its natural resources, to make it the driving force of its socio-economic development. Industrialization has been at the heart of the various development models adopted since then, even if the intensity varies from time to time. A preliminary survey covering the period 1963-1990 makes it possible to distinguish various eras, as follows:

- 1963-1985: era characterized by a planned economy. Industrialization follows a self-centered development model, autonomous (protected) from the capitalist world economy, whether in the external domain (state monopoly of foreign trade) or in the internal domain (predominant public sector). In the development strategy, industrialization plays a central role, and the hydrocarbon sector must appear as a highly integrated state complex, subject to centralized management (Nashashibi et al., 1998). The importance and structure of investment in this sector have a twofold objective (Benabdellah, 2009) : first, to provide the necessary financing in foreign currency to the rest of the economy so that it reaches maturity; second, to gradually switch from upstream to downstream (petrochemical, fertilizer, plastic, pharmacy, etc.) hydrocarbons knowing that only the latter is industrializing. Finally, overall, the evolution of the economic model depends on the stated objectives that are (Talahite and Bouklia-Hassane, 2011): the creation of a basic industry, intersectoral industry-agriculture integration, the development of natural resources and job creation. The era is in turn subdivided into three significant time intervals:



- 1963-1977 : Various development plans (three-year plan 1967-1969, ^{1st} four-year plan 1970-1973 and ^{2nd} four-year plan 1974-1977) followed one another, with a massive injection of capital into the economy, especially in industry (The investment rates relative to GDP are of the order of 28%, 39% and 45% on average during the three successive plans) (Hadjseyd, 1996). Over the entire period, the amounts of planned investments allocated to hydrocarbons (mainly composed of crude oil, condensate and refined products) to other industries combined (excluding hydrocarbons and excluding Public Works Buildings (BTP)) are respectively of the order of 40.04 and 45.3 billion Algerian Dinars (DA) current (46.45% and 53.55% of the shares of the total amount allocated to the industry) (World Bank Memorandum, 1978). The hydrocarbons sector already had a 46% share of total added value in 1970, showing an over-achievement compared to the planned objectives. The declared desire to carry out a certain rebalancing during the second four-year plan, in favour of basic industries (intermediate goods and capital goods), is effectively abandoned, in favour of investment in the hydrocarbons sector. Following the nationalization of 1971, and the oil shock of 1973 (in one year, the price of a barrel rose from about 3 to 12 USD), the hydrocarbon sector saw its function as a provider of foreign exchange increase further. It accounts for 84% of exports on average, during the period from 1967 to 1979 (more than 95% in 1977). This sector is a source of rent to meet debt service, and continue to maintain extensive growth; the high level of GDP growth (5.9% on average between 1965 and 1980) is therefore the result of a massive and continuous injection of capital and not intensive exploitation of installed equipment.
- 1978-1979 : The investment rate based on GDP was over 50% in 1978 (Hadjseyd, 1996). Correspondingly, the hydrocarbons sector captures 56% of industrial investment. Nevertheless, this period sees a pause in order to dispatch late projects and implement those that are still outstanding. The oil shock of 1979 ended up re-boosting crude prices (the price of crude was multiplied by 2.7 between mid-1978 and 1981). The effects are carried over to the following period.
- 1980-1985 : economic infrastructure increased and diversified: civil engineering works, hydraulic dams, roads, trains, health, education and administration. The period included 1980-1984 (under the ^{1st} Five-Year Plan) is considered the best for the non-hydrocarbon industry, from the point of view of productivity and value added (Hadjseyd, 1996). The hydrocarbons sector persists in staying away from external competition and does not keep up with technical progress. It lacks competitiveness to assert itself in global energy markets. The lack of investment in the means of production and exploration is starting to slow down the expansion of the sector. Between 1980 and 1982, the share of crude oil production reserved for export increased from almost 80% to less than 30% (OPEC quota limitation, depletion of obsolete deposits and extraction processes) while the exported share of refined petroleum products, condensates and liquefied natural gas (LNG) increased threefold. At the same time, the promotion of heavy industries involves



colossal investments and high energy consumption. The subsidy policy for energy products is skyrocketing local energy demand – per capita consumption tripled between 1972 and 1983. To appease the growing social aspirations, an over-import policy, focused on consumer goods, is launched. The economic model demonstrates a vulnerability to successive economic hazards and in particular the great crisis that occurred after 1985 following the sudden fall in crude prices.

2. The Period of [1990-2023] – Counter-shock of 1986

- 1986-1993 : The balance of payments crisis caused by the sharp drop in hydrocarbon prices (from an average of 27 to 15 USD) led to a collapse in the value of exports (which fell by 55.5% between 1984 and 1987). Imports also decreased by 54%. The economic impact is immense and hits the industrial sector hard. The consequences are disastrous: budget deficit and lack of liquidity, doubling of the volume of total debt (\$26 billion and debt servicing representing 72% of exports) between 1985 and 1988, GDP at 0.1% growth between 1985 and 1990, multiplication of social violence from 1986. The system is in crisis, and medium and long-term planning (2nd Five-Year Plan 1985-1989) is abandoned, to respond to the most urgent. Investments in the hydrocarbon sector are the most affected; they decreased by 68%, from 16% to 10% of overall public investment between 1985 and 1989 (compared to 29% between 1967 and 1979). They account for about 35% of industrial investment (compared to 46% for the rest of the industry) (Hadjseyd, 1996). A hydrocarbons law that was promulgated in August 1986, then amended in 1991, opened the way for foreign investment. Correspondingly, the share of hydrocarbons reached 97% of export revenues, during the period from 1980 to 1989, due, of course, to the rise in prices on world markets, but also to the collapse of the export of agricultural products and other mining products (phosphates, iron). The private sector appears from 1985 and is listed as a whole in the "other industries" section; it manages to collect 28.5% of investments. The limitations of the centralized economic planning model are obvious. A debate is opened on how to regulate the economy. Between 1988 and 1989, Algeria began an economic and political process of post-socialist transformation; centralized economic planning gave way to a comprehensive reform aimed at restoring competition and, more generally, market mechanisms. A first agreement was concluded with the International Monetary Fund (IMF) (May 1989-May 1990). In 1991, the state monopoly on foreign trade was annulled. Currency devaluations (25% in 1991) and accelerating inflation (about 32% in 1992) discourage large private investments. The reforms, driving the process of economic transformation in Algeria (Talahite, 2012) were interrupted in June 1991, and definitively buried by the cessation of the electoral process in 1992.
- 1994-2000 : the external debt obliges Algeria to accept the structural adjustment programmes (SAPs), during the period [1994-1998], formulated by international institutions, which advocate: macroeconomic stabilization, openness to foreign trade and a series of privatizations. These programs apply to an industry that has



been severely weakened by a nearly 10-year recession (Benabdellah, 2009). This period was marked by great political and social instability; the currency devaluations of 50% and then 15% in 1994 alone had the effect of aligning domestic prices with international prices to achieve the convertibility of the national currency for current transactions in 1997. The civil harmony of 1999 put an end to a black decade, full of turbulence. The sectoral participation of hydrocarbons in the overall GDP in the period [1993-1997] is of the order of 25.8% on average. Hydrocarbon revenues are much more unstable than non-hydrocarbon revenues: the coefficient of variation of hydrocarbon revenues (corresponding to their share in non-hydrocarbon GDP) is three times higher than the corresponding coefficient of non-hydrocarbon revenues, mainly because of the large variations in world oil prices. In the period [1994-2000], the upward trend in hydrocarbon revenues peaked in 2000 with a sharp decline in 1998 (Asian market crisis). Between 1989 and 2003, hydrocarbon budget revenues represent on average two-thirds of total budget revenues, and their average annual growth rate over the same period is over 7%. In 2000, the Algerian public administration created the Revenue Regulation Fund (FRR). This fund is off-budget; it aims to: 1) replenish the external reserve buffer used in 1998–1999 (a period when hydrocarbon revenues remain low); 2) service the public debt in a context where bank financing capacities (Treasury) are limited and non-bank financing capacities (sector bills) are poorly developed; and 3) smooth the long-term profile of expenditure.

- 2001-2007 : The economy recovers its basic financial balance through structural reforms (for hydrocarbons a law was enacted in 2005 and amended in 2006), higher hydrocarbon prices combined with significant export volumes and greater economic stability. However, with the exception of hydrocarbons, economic growth remains stagnant and industrial decline continues; between the periods [1990-1999] and [2000-2006], the structure of non-hydrocarbon industry (public and private) shifts more from heavy industry to light industry with a predominance of the public sector. Hydrocarbons have a very important effect on growth due to their increasing weight in GDP (45% in 2006, compared to 38% in 2004 and less than 30% on average during the 1990s). In total, more than 90% of the growth is generated by hydrocarbons and the non-tradable goods sector (services, other services, construction and construction). This is a real process of deindustrialization that deepens from year to year.

In February 2007, a new industrial strategy was put in place with the objectives of: 1) increasing the share of industry in GDP; 2) creating diversification of the economy and exports; 3) increasing the contribution of industry to job creation.

- 2008-2014 (1st semester): period of oil boom and accumulation of reserves par excellence. Indeed, between 2008 and 2014, oil prices reached high levels, peaking at nearly USD 140 per barrel in 2008, followed by a stabilization around USD 100-110 between 2010 and 2014. The impact on the economy is significant: Hydrocarbon revenues allow Algeria to accumulate significant foreign exchange



reserves, reaching a peak of \$194 billion in 2013. At the same time, the state increases public spending, especially in civil servants' salaries and social transfers, which has the effect of stimulating domestic consumption. GDP continues to grow steadily, with an average of 3 to 4% per year, mainly driven by the hydrocarbons sector.

- 2014 (2nd half)-2016: this is a period marked by the oil counter-shock and adjustments. From the^{second} half of 2014 and continuing until 2016, oil prices fell dramatically, from more than USD 100 per barrel to around USD 30 in 2016. The economy suffers heavily, judging by: falling export revenues, leading to a large budget deficit and a reduction in foreign exchange reserves. GDP is slowing down, from 4.0% in 2014 to 1.4% in 2019, due to the decline in public investment and the contraction of the non-oil sectors. The government must reduce public spending and implement austerity measures to deal with the resulting budget deficit.
- 2017 -2019: The era of partial stabilization and limited diversification. Indeed, oil prices partially stabilized between 50 and 70 USD per barrel in the period considered. Hydrocarbon revenues increased significantly, allowing a stabilization of foreign exchange reserves and a reduction in the budget deficit. Notwithstanding efforts to diversify the economy, non-hydrocarbon exports remain marginal, accounting for less than 2% of GDP in 2019. Unemployment, especially among young people, remains high (26.9% in 2019), and inflation is taking on significant proportions, reaching 10% on average.
- 2020-2021: The COVID-19 pandemic, which is spreading globally, is leading to a multidimensional crisis, resulting in, among other things, a sharp fall in global oil demand, with prices falling to historically low levels (around 20 USD per barrel in April 2020). Export earnings are falling substantially, by around 30%, and GDP is contracting by 5.5% in 2020, marking an economic recession. The budget deficit is widening, and foreign exchange reserves are decreasing, highlighting the vulnerability of the Algerian economy to external shocks, for the umpteenth time. To offset this, the government is putting in place economic support measures, but recovery is slow due to persistent dependence on hydrocarbons.
- 2022-2023: Oil prices rebound, averaging USD 106 per barrel in 2022, due to both the global economic recovery and ongoing geopolitical tensions (war in Ukraine). Export earnings are increasing, allowing a stabilization of foreign exchange reserves and a reduction in the budget deficit 112. GDP is growing by 4.1% in 2023, supported by increased natural gas production and strategic partnerships with international companies. **Prospects for diversification start timidly**; non-hydrocarbon exports increase from 0.7% of GDP in 2017 to 1.8% in 2023, but remain marginal. Oil price volatility and dependence on hydrocarbons remain major risks for the Algerian economy.



III. Methodological notes- Analysis and Discussions:

1. Choice of variables :

The choice of variables: Oil Price, Exchange Rate, GDP Growth Rate, Consumer Price Index and Fiscal Expenditure in our study on the impact of oil price change on the Algerian economy is justified by their economic relevance for a robust and comprehensive analysis.

- **Oil price** : is the central "independent" variable of our analysis, it makes it possible to measure the impact of oil prices on the Algerian economy.
- **GDP growth rate** : is the "dependent" variable, an important indicator in economic activity. It shows the overall effect of oil price changes on domestic production.
- **The Exchange Rate** : Oil revenues can have an influence on the value of the Algerian dinar.
- **The consumer price index** : measures the evolution of goods and services consumed by households. Variable "dependent", it evaluates the effect of oil prices on inflation and purchasing power.
- **Budgetary expenditure** : State revenues consist mainly of oil revenues that influence public expenditure.

These variables make it possible to effectively analyze our subject on the impact of oil prices on the Algerian economy in the budgetary and monetary fields and give an overview of the vulnerability of our economy.

2. Analysis of stationarity tests (ADF - Augmented Dickey-Fuller)

Series	Level (None)	Intercept	Trend & Intercept
Exchange rate	0.9988Non-stationary	0.9988Non-stationary	0.0096 Stationary
TC GDP	0.1971Non-stationary	0.0043Non-stationary	0.0043 Stationary
GDP	0.9473Non-stationary	0.9261Non-stationary	0.5436 Non-stationary
IPC	0.1438Non-stationary	0.4210Non-stationary	0.7386 Non-stationary
DB	0.9995Non-stationary	0.9984Non-stationary	0.6229 Non-stationary

With a trend and a constant , **EXCHANGE_RATE** and **TC_GDP** become **stationary**. However, **GDP**, **CPI** and **DB** remain **non-stationary**.

With a constant, **all series become stationary at the first difference**.

3. Measuring the impact of oil price on variables:

3.1. Impact of Oil Price on GDP Growth Rate

For the time series of the 1st differences variables (dependent and independent), the possibility of cointegration must be checked. The analysis of Johansen's cointegration test for the impact of oil price on GDP growth rate shows the following results:



a. Cointegration rank test (Trace and Max-Eigenvalue)

Rank Assumption	latent roots	Trace Statistics	Critical value 5%	P-value	Conclusion
None (None)	0.5598	42.5337	15.4947	0.0000	H_0 release, presence of at least 1 co-integration relationship
At most 1	4238	17.0932	3.8414	0.0000	H_0 rejection, presence of 2 co-integration relationships

- The Trace test and the maximum eigenvalue test indicate the presence of **two cointegration relationships** at the 5% threshold (P-value < 0.05).
- This means that there is a long-term relationship between changes in oil prices and the rate of GDP growth.

The cointegration equation obtained is:

$$DTC_GDP = 1.000000 + 0.090497 \text{ DPRICE_PETROLE_OPEC}$$

b. Error Correction Equation (VECM)

- The correction error (CointEq1) has a negative coefficient (-0.001304), indicating an **adjustment towards long-term equilibrium**.
- However, the coefficient is not statistically significant (t-statistics = -0.03159), suggesting that error correction is **low or non-existent**.

c. Granger Causality Test

Dependent variable	Excluded Variable	Chi2Statistics	Degrees of freedom	P-value	Conclusion
D_TC_GDP	D_PRICE_PETROL_OPEC	0.6319	2	0.7291	No Granger causation
D_PRICE_PETROL_OPEC	D_TC_GDP	1.66	2	0.4345	No Granger causation

- The test shows that **the oil price does not directly cause the GDP growth rate** (P-value = 0.7291), indicating that changes in oil prices have no significant effect on economic growth in the short term.

3.2 Impact of Oil Prices on CPI

The objective here is to assess whether and how oil price fluctuations influence the CPI in Algeria, by analysing the econometric tests carried out.

Before analyzing the relationships between the variables, it is essential to check their stationarity using the **ADF (Augmented Dickey-Fuller) test**.

To determine whether the CPI and oil price have a **long-term relationship**.

**Table 1: Trace and Max-Eigenvalue test results**

Rank Assumption	latent roots	Trace Statistics	Critical value 5%	P-value	Conclusion
None (None)	0.5388	44.2627	15.4947	0.0000	H ₀ release, presence of at least 1 co-integration relationship
At most 1	0.4800	20.2743	3.8414	0.0000	H ₀ rejection, presence of 2 co-integration relationships

From the above table , we can notice that:

- **Oil prices and the CPI move together over the long term.**
- **There are at least two co-integration relationships**, which confirms a structural dependence between these two variables.

We now move to the Granger Causality Test with the **Objective: To verify whether oil prices influence the CPI in a causal manner.**

Table 2: Granger causality

Dependent variable	Excluded Variable	Chi2Statistics	Degrees of freedom	P-value	Conclusion
D(CPI)	D_PRIX_PETROL_OPE C	0.2893	2	0.8653	No Granger causation
D_PRIX_PETROL_OPE C	D(CPI)	0.6264	2	0.7311	No Granger causation

The results indicates that:

- Changes in the price of oil do not directly cause changes in the CPI.
- This reinforces the idea that price regulation policies in Algeria limit the immediate transmission of oil shocks to inflation.

4. Impact of Oil Prices on the Exchange Rate

The objective here is to evaluate how oil price fluctuations influence the **exchange rate** in Algeria, through the analysis of the econometric tests carried out.

First, we check whether the exchange rate and the price of oil have a **long-term relationship**.

Table 3: Trace and Max-Eigenvalue test results

Rank Assumption	latent roots	Trace Statistics	Critical value	P-value	Conclusion
None (None)	0.6404	43.4360	15.4947	0.0000	H ₀ release, presence of at least 1 co-integration relationship
At most 1	0.3150	11.7282	3.8414	0.0006	H ₀ rejection, presence of 2 co-integration relationships



• **From this table we see that :**

- Oil prices and the exchange rate move together over the long term.
- There are at least two co-integration relationships, which confirms a structural dependence between these two variables.

Then we move to a Granger Causality Test with the Objective: To verify whether oil prices influence the exchange rate in a causal manner.

Table 4: Granger causality

Dependent variable	Excluded Variable	Chi2Statistics	Ddl	P-value	Conclusion
D_exchange_rate	D_prix_petrol_opec	6.3184	2	0.0425	Causality detected
D_prix_petrol_opec	D_exchange_rate	4.2712	2	0.1182	No causation

We could clearly see that :

- Fluctuations in oil prices directly influence the exchange rate in Algeria.
- On the other hand, changes in the exchange rate do not seem to affect oil prices.

5. Impact of Oil Prices on Budgetary Expenditure

The objective here is to assess how oil price fluctuations influence public spending in Algeria, by analysing the econometric tests carried out.

We perform the test of cointegration to check whether public expenditure and the price of oil have a long-term relationship.

Table 5: Trace and Max-Eigen value test results

Rank Assumption	latent roots	Trace Statistics	Critical value	P-value	Conclusion
None (None)	0.3835	25.7645	15.4947	0.0000	H0release, presence of at least 1 co-integration relationship
At most 1	0.2935	10.7691	3.8414	0.0010	H0rejection, presence of 2 co-integration relationships

• **The main results from this table are:**

- Oil prices and government spending move together over the long term.
- There are at least two co-integration relationships, which confirms a structural dependence between these two variables.
- adjust when prices fall.

We then proceed to a Granger Causality Test to verify whether oil prices influence public spending in a causal manner.

**Table 6: Granger causality**

Dependent variable	Excluded Variable	Chi2Statistics	Ddl	P-value	Conclusion
D(DB)	D_prix_petrol_opec	9.2039	2	0.0019	Causality detected
D_prix_petrol_opec	D(DB)	4.2712	2	0.1182	No causation

The main findings from this table are:

- Fluctuations in oil prices directly determine the level of public spending in Algeria.
- On the other hand, budgetary decisions do not have a significant effect on oil prices.

IV. Discussions, Analyses and Conclusions

The Algerian economy went through several oil cycles between 1990 and 2023, marked by periods of boom, crisis and partial recovery.

The contrast between recent growth and future projections highlights a major challenge for Algeria: although the country has demonstrated resilience and growth, especially in its hydrocarbons sector, it remains highly vulnerable to external factors, especially to fluctuations in global oil prices. This persistent vulnerability accentuates the urgency of economic diversification and structural reforms to ensure sustainable growth in the face of the volatility of global energy markets.

This study rigorously examines the impact of oil price changes on Algeria's economic activity using the Vector Error Correction Model (VECM). The latter elucidates the complex interactions between oil prices represented by the OPEC basket reference values, and four macroeconomic transmission channel variables which are the GDP growth rate, the DZD/USD exchange rate, the CPI Consumer Price Index as well as budgetary expenditure. The scope of the results obtained is considered in the short and long term. The following interpretations are drawn:

- Oil prices do not have a significant impact on the GDP growth rate either in the short or long term, which can be attributed to the weak diversification of the Algerian economy and the high dependence on oil revenues.
- Oil prices influence the CPI over the long term, reflecting an inflationary transmission via production and transport costs. In the short term, the impact is negligible, probably due to grant policies.
- Higher oil prices tend to strengthen the local currency due to improved export earnings. The short-term link indicates immediate sensitivity to changes in oil prices.
- Higher oil prices increase tax revenues, allowing for an expansion of public spending. This relationship indicates fiscal vulnerability to oil shocks.

The interpretations formulated, to explain the behaviour of the four variables in the face of price fluctuations in the OPEC basket price, must be considered in a context of asymmetric effects of price changes, and the complex nature of institutional and political environments. The judicious choice of time series data on oil prices, macroeconomic



indicators and sectoral data is essential for empirical analysis. The relevance of the choice of the VECM model in this empirical analysis is well established.

The results highlight the vulnerability of the Algerian economy to fluctuations in oil prices, particularly with regard to the CPI, the exchange rate and budgetary expenditure. Economic diversification and the establishment of macroeconomic stabilization mechanisms are essential to strengthen the resilience of the Algerian economy in the face of oil shocks.

The Algerian economy is structurally dependent on hydrocarbons, which is manifested by:

- High sensitivity to changes in oil prices over the long term
- A delayed effect of price changes on economic growth
- A lack of significant short-term effect due to oil revenue management mechanisms

Because of its heavy dependence on hydrocarbons, Algeria is condemned to work for a diversification of its economy, in order to reduce its sensitivity to changes in oil prices. Economic policies must focus on regular and efficient comfort for the existing hydrocarbon sector, but above all they must accelerate structural reforms and invest in non-hydrocarbon sectors with high added value, such as agriculture or information and digital technologies. The promotion of private investment and the establishment of mechanisms to stabilize public finances, to cope with fluctuations in oil prices, are other issues to be negotiated as soon as possible. It is at this price that the resilience and robustness of the economy in the face of external shocks and adverse economic conditions will be consolidated.

Overall, this study aims to deepen the understanding of the economic issues facing Algeria due to its high dependence on oil revenues. The recommendations issued are intended to assist policymakers in designing appropriate strategies to ensure more resilient and stable economic growth, regardless of changes in oil prices.

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