



The impact of the US shale oil revolution on OPEC's share in the oil market for the period (2000-2024)

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Abstract

This study aims to analyze the impact of shale oil production development on OPEC's share of global oil production during the period 2000–2024, in light of the structural transformations witnessed in the global oil market. The study employed the Autoregressive Distributed Lag model (ARDL) to examine the relationship between OPEC's market share and a set of explanatory variables, including oil prices, global oil demand, renewable energy, and shale oil share in global production. The findings revealed the existence of a long-run equilibrium relationship among the variables. The results also indicated that global demand supports OPEC's market share, whereas the expansion of shale oil production and renewable energy poses an increasing competitive challenge to OPEC's position in the global oil market. The study concluded that shale oil has become a structural factor influencing the balance of global oil supply, requiring OPEC to adopt more flexible production policies to maintain its market share.

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Introduction

Since 2014, the global oil market has undergone a radical transformation from "scarcity" to "abundance" thanks to the technological revolution that has enabled the United States to exploit its vast shale oil reserves. This new variable was not just a quantitative addition to the global supply, but it was a change in the rules of the economic game, as shale oil is characterized by high flexibility and a short investment cycle that makes it a new "swing producer" that responds very quickly to price fluctuations. In the American and Asian markets, this pressure prompted the organization to change its

philosophy from targeting a specific price to defending market share, which was manifested in the famous price struggles leading up to the formation of the OPEC+ alliance in an attempt to restore the lost balance.

Importance of the research:

The importance of the research came through the role of shale oil in the development of unconventional hydrocarbon energy sources and its impact on reducing OPEC's share of global crude oil production, and thus reducing OPEC's influence in the oil market.

Research Objective:

The research aims to review the most important developments that have occurred in the global oil industry through the role of shale oil in reducing the role of OPEC in the oil market and oil production, and the future role that consuming countries may play in the international oil market after their transformation into oil and gas exporting countries.

Research Problem:

The problem with the research is that many of the oil-producing countries within OPEC have ignored the influential role of shale oil in the oil market, and have been busy increasing their oil production with the significant rise in oil prices in the late 2000s, creating opportunities to develop extraction techniques for unconventional sources of hydrocarbons, which has cast a shadow over the new future role Shale oil will play a role in reducing OPEC's share of global oil production.

Research Hypothesis:

There is a statistically significant relationship between U.S. shale oil production and OPEC's share of global oil production during the period 2000–2024, and the effect is expected to be negative.

Research Methodology:

The research relied on the descriptive-analytical and econometric approaches. Annual data were used for the period (2000–2024), and standardly, the Unit Root Test (ADF), the Bounds Test were used, then the ARDL model was estimated and the short- and long-term results were analyzed through the Error Correction Model (ECM).

Topic One: Shifts in Global Oil Production

First: The development of global oil production:

Global oil production has witnessed significant development since the beginning of the modern oil industry in the nineteenth century until 2024, as production growth has been associated with the expansion of industrial activity, technological

development, and the rise in global demand for energy. The modern oil industry began in 1859 with the drilling of the first successful commercial oil well in the US state of Pennsylvania, and then gradually expanded production with the discovery of new fields in the United States, Russia, and the Middle East (EIA, 2024). During the first half of the twentieth century, oil became a major source of global energy, especially after the proliferation of internal combustion engines and the expansion of transportation and heavy industry. After World War II, global demand rose dramatically as a result of the reconstruction of Europe and global industrial expansion, which led to an accelerated increase in global oil production. IEA data indicate that this phase has seen the center of oil gravity gradually shift towards the Middle East due to large reserves and low production costs (IEA, 2023). In 1960, the Organization of the Petroleum Exporting Countries (OPEC) was established with the aim of coordinating oil policies among member countries and stabilizing global oil markets. The Organization played an important role in managing production levels and prices, particularly during the 1970s when oil markets experienced sharp price rises as a result of geopolitical crises and the oil embargo (OPEC, 2024). During the 1980s and 1990s, the oil market witnessed an increase in the production of non-OPEC countries, such as Russia and the North Sea, which led to a rise in global supply and increased competition within the oil market. Oil prices have also been subjected to cycles of rise and fall depending on global economic changes and levels of demand and production (BP, 2023). At the beginning of the 21st century, global oil production rose markedly as a result of rapid economic growth in emerging economies, particularly China and India. The U.S. Energy Information Administration reports that the growing global demand has prompted many countries and companies to

expand investments in the exploration and production sector, resulting in continuously higher global production levels until 2008 (EIA, 2024). However, the global financial crisis of 2008 led to a decline in global economic activity and a decline in oil demand, causing prices and production to fall temporarily. The oil market gradually rebalanced as the global economy improved, but the biggest shift came after 2010 with the significant expansion of U.S. shale oil production. Horizontal drilling and fracking techniques have helped significantly increase U.S. production, making it one of the world's largest oil producers (Maugeri, 2013). This expansion of shale oil led to an increase in global supply and a clear oil surplus during 2014, causing oil prices to fall sharply. This has also led to a shift in the balance of power within the global oil market, as OPEC is no longer the only supply-side influencer, but shale oil has become a major factor in determining global market trends (Fattouh and Sen, 2015,pp.9).

In 2020, global oil production suffered a significant decline as a result of the Corona pandemic, as the global lockdown and reduced transport and industrial traffic caused an unprecedented decline in global demand for oil. The International Energy Agency (IEA) reports that during this period, the oil market witnessed the largest decline in demand in decades, prompting OPEC+ to adopt production reduction agreements to support market stability (IEA, 2021). As the global economy recovers from the pandemic, global oil production has gradually risen to about 97 million barrels per day in 2024, with the United States, Russia, and Saudi Arabia continuing to be the top producers. Shale oil and renewable energy have also become key factors influencing the future of the global oil market, making the oil industry more relevant to technological development, environmental shifts, and international energy policies (BP, 2023).

Second: The Emergence of OPEC and the Development of Its Market Share:

Crude oil prices before 1862 were as high as \$2 per barrel, but the extraction of crude oil in large quantities that year at Titusville in the US state of Pennsylvania caused the price of a barrel to drop to no more than 10 cents, and in 1913 the price of a barrel of crude oil at the Gulf of Mexico was equal to 80 cents, then it dropped to 40 cents in 1914, then it rose to \$1.25 per barrel in 1921, and after the discovery of oil in 1921. Under the Achnacarry Agreement in 1928, oil companies agreed that oil prices would be determined at every point in the world by reference to the prices in force in the Gulf of Mexico and without taking into account the real source of oil (Madureire,N.L.2017,pp685-689).

The United States was interested in lowering the price of oil sold to European countries, as it was incurring huge expenses, especially after the implementation of the Marshall Plan to revive Europe, as America pressured the major oil companies to reach a compromise under which Middle Eastern oil would be allowed to rise slightly from \$1.05 per barrel in 1945 to \$1.75 per barrel FOB Arab light density 34 The American Petroleum Institute (API) in 1950, while the price of U.S. crude increased from \$1.36 per barrel in 1945 to about \$2.76 per barrel in the Gulf of Mexico in 1950. Inflation adjusted oil prices for a decline of about 80% from 1947 until 1970, after which OPEC took the lead and reversed what had been the case before, and being sovereign countries The new owners of oil reserves within OPEC were free to raise the price cap on oil to a level that was considered profitable according to their perceptions, which differed markedly from those of the international oil companies that previously ran the oil industry in their countries (Adelman, 1991,pp.45-49).

Thus, the Western economic literature that views OPEC as a monopoly grouping, and

according to the idea of the oil market, it will then be pointed out that the price change under the OPEC era in the 1970s is nothing but an adjustment process, as the path of production at competitive prices that was managed by the big oil companies was abandoned in favor of the monopolistic price path managed by the national governments in OPEC. Prior to the first price adjustment in 1973, monopoly oil companies controlled the pricing mechanism of crude oil, and by virtue of their efforts to keep oil prices at low levels, many countries shifted from consuming other energy sources such as coal to oil, which is less polluting to the environment compared to coal, so the volume of oil supply was larger than the rest of other energy sources, and this can be seen through the relative importance of the global supply of oil compared to other energy sources, which reached In 1971, after the first and second price adjustments took place in the 1970s, there was a slow shift away from oil towards other alternative energy sources due to the fact that there was a long time required to replace alternatives, which led to a rise in oil prices at a later stage, and the energy policies adopted by many industrialized countries aimed at restricting the demand for oil had an effect on reducing the relative importance of the volume of the global supply of oil compared to other energy sources It had reached about 47.85% in 1981 (Yergin,1991,pp.720-730).

As OPEC increased its oil production in an attempt to regain its market share, this coincided with the increase in production of non-OPEC countries, leading to the price crash in 1986, and due to a combination of low oil consumption and high OPEC production, oil prices spiraled down to \$10 per barrel in 1998. In light of OPEC's reaction and agreement with Russia to reduce the volume of oil production, and the recovery of Asian economies in early 1999, oil prices had risen to reach above \$25 per barrel, and during the period "2000-2003" the price structure was

more stable, and the monthly and annual oil prices varied between \$23-30 per barrel, and during the period "2004-2014" The size of the US oil reserves decreased and the US refining capacity was limited, and the volume of Asian oil demand witnessed a significant increase, as well as the turmoil in the Persian Gulf after the occupation of Iraq and speculation in the oil exchanges, so that oil prices recorded their highest level in June 2008 at \$147.02 per barrel. However, oil prices fell again after that, due to several factors, including the increase in oil supply to the producing countries, the development of the size of oil reserves and its derivatives, and the impact of the repercussions of the global financial crisis on consumer countries, but the biggest impact was due to the newcomer who entered the oil market through the American portal, namely Sijil oil, or what is known as shale oil that changes the rules of the oil equation (Maugeri,2013,pp.23-30).

Second Topic: The Development of Shale Oil Production

First: What is shale oil and its extraction mechanism:

Shale oil is generally known as one of the hydrocarbon resources extracted from the shale, which is clay rock layers that have been subjected to thermal maturation processes under the pressure and heat of the earth's interior, and these materials remained trapped within the rock formations that prevented them from natural migration towards the surface, which made their extraction by traditional means impossible in the past, hence the modern technique of extracting this oil using hydraulic fracturing) which is the pumping of a mixture of water, sand and chemicals at very high pressure. In order to purify hard rocks and open their pores, allowing oil and gas trapped at depths of thousands of meters to leak and flow towards the well (Mohammed, 2014), however, the march of this sector faced major economic

challenges in the 1980s, as by 1984, the reduction of tensions in the Middle East region and the availability of new oil supplies from outside OPEC (such as North Sea production) in conjunction with the decline in global demand led to a sharp collapse in prices from \$31 to \$10 per barrel. Shale oil projects in the United States of America due to their economic feasibility at the time (Department of Energy, 2004), but due to the emergence of energy deficit crises and the rise in prices in the global markets, all of this constituted the greatest role in stimulating the search for innovative alternatives to conventional fuels, especially in the transportation sector, and these alternatives included fuels extracted from the liquefaction of natural gas and coal, as well as the production of oil from the Sijili shale (Maugeri, 2013, pp.8-12).

Shale oil extraction by American companies has witnessed rapid growth in recent years, leading to an unexpected boom in global energy markets (Al-Shammari et al., 2021) and with the beginning of the twenty-first century, there has been a radical change in the landscape, as the continuous rise in oil prices has contributed to making the use of advanced technologies a highly economically feasible option, hence the emergence of hydraulic drilling techniques as pivotal tools in the extraction of Sijil oil or what is known as (narrow oil), which is the term Approved by the U.S. Energy Information Administration (EIA) to refer to oil extracted from low-permeability formations via horizontal drilling (2025, EIA).

Second: Economic characteristics of the shale oil production mechanism:

Understanding the economic characteristics of the shale oil production mechanism is essential for academic analysts as it is radically different from the structural characteristics of conventional oil, and this in turn directly affected the decisions of the OPEC organization, and these characteristics can be summarized as follows:

1- Supply elasticity and short-cycle investment: Supply elasticity and short-cycle investment are the most prominent features in the shale oil sector, as the extraction industry has moved from the mega-projects model to the just-in-time manufacturing model. This flexibility is reflected in the ability of producers to respond to price fluctuations, while conventional oil (especially in deep-sea offshore fields) needs time periods ranging from 5-10 years from the beginning of exploration to the first production barrel, while shale oil companies can complete the drilling, fracking and grid cycle in just 4-6 months (Yergin, 2020). Operating rigs immediately to absorb profits, and when prices collapse, operations can be stopped without a huge loss, and this advantage has reduced the effectiveness of the (weighted production) policy practiced by OPEC, as the organization is facing a competitor capable of entering and exiting the market with high flexibility, which has shortened the duration of price cycles and made them more volatile (Fattouh&Sen, 2015, pp.22-27).

2- The phenomenon of rapid decline in production (High Decline Rates): Shale oil wells suffer from accelerated depletion, unlike traditional wells that maintain a stable level of production for years, as the shale oil well loses between (60-70) % of its production capacity in the first year of operation, which made this characteristic of imposing a continuous race on companies to drill (drilling-to-stay-even.) i.e., the company is forced to constantly drill new wells just to maintain its current level of production, making cash flows very sensitive to drilling costs (Saleh et al., 2024).

3- Scalability and modularity, as shale oil companies can start with small areas and gradually expand their operations according to the availability of liquidity, unlike traditional projects that require a financial commitment of billions of dollars before producing a large barrel, this stereotype allowed hundreds of small and medium-sized companies to enter

the competition, which made it difficult for OPEC to negotiate unilaterally to control the American supply, as large and government companies do (Rodhan, 2023,pp.438-440).

Third: Shale Oil and OPEC Market Share:

OPEC plays a key role in the process of controlling oil supply and prices, but the development of shale oil extraction technology and its money has played a role in reducing the cost of shale oil production, leading to a significant boom in its production, making the United States one of the world's largest oil producers. All of this played a major role in changing the composition and movement of the oil market, thus affecting OPEC's share in the global market. We find that before the growth of shale oil production, OPEC controlled a large part of the global production ranging between (41-38.6) per day, as can be seen from Table (1), which indicates that OPEC's share of global production fell to less than 29% after the growth of shale oil production.

Table (1) OPEC Oil's Share of World Production

Sunnah	US Oil Production (Mb/d)	U.S. Shale Oil Production (Mb/d)	OPEC Production (Mb/d)	Global Oil Production (Mb/d)	OPEC's share of global production (%)
2000	7.73	0.05	26.040	66.36	29.24
2001	7.67	0.06	25.430	66.33	38.66
2002	7.62	0.07	23.770	65.77	36.14
2003	7.37	0.08	27.150	70.18	38.68
2004	7.25	0.09	29.22	72.92	40.07
2005	6.90	0.10	30.32	74.06	40.93
2006	6.83	0.12	30.34	74.21	41.00
2007	6.86	0.14	29.98	74.22	40.39
2008	6.78	0.25	30.09	74.55	40.36

2009	7.27	0.40	28.44	74.24	38.30
2010	7.56	0.82	28.76	74.45	38.62
2011	7.89	1.45	29.41	75.10	39.26
2012	8.93	2.25	30.70	76.82	39.96
2013	10.10	3.20	29.66	76.82	38.60
2014	11.80	4.07	29.73	78.63	37.80
2015	12.77	4.85	30.95	80.94	38.23
2016	12.36	4.30	32.00	80.99	39.51
2017	13.14	5.10	31.98	81.21	39.37
2018	15.32	6.40	31.30	82.93	38.46
2019	17.14	7.30	29.88	81.13	36.38
2020	16.51	5.90	26.13	75.83	34.45
2021	16.73	7.40	27.03	77.02	35.02
2022	17.94	8.00	29.64	80.95	36.61
2023	19.44	8.32	29.15	82.09	35.50
2024	20.28	8.90	29.15	82.03	35.53

Source: Compiled by the researcher based on OPEC Annual Statistical Bulletin 2000-2024, European Energy Agency 2000-2024

In fact, the increase in shale oil production has played a key role in increasing the global supply of oil, putting significant pressure on OPEC in terms of changing production policies and oil prices. This is done by controlling the reduction or increase of production through the mechanism of determining production quotas for OPEC member countries to balance the oil market. OPEC, along with its partners such as Russia in the OPEC+ countries, has taken steps to adjust production to mitigate the impact of shale oil on OPEC prices and market share. However, OPEC's focus on emerging markets, especially Asia, has helped generate strong demand even as global shale oil production rises, partially reducing the impact of shale oil on OPEC's share decline.

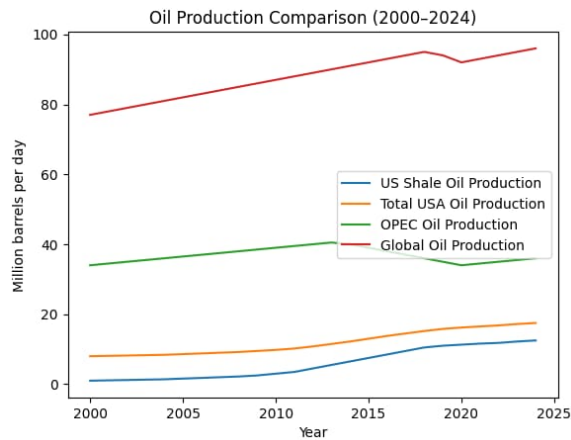


Figure (1)

Referring to Figure (1), we note the relative stability of OPEC's production along with fluctuations related to production policies and global crises, while shale oil production has experienced accelerated growth since 2010, which has led to an increase in global supply and a decline in OPEC's ability to maintain its market share.

The accelerated growth in shale oil production since 2010 has led to a significant rise in total U.S. production, in contrast to relative stability or a limited decline in OPEC production over some periods. The chart also shows that the increase in U.S. production has contributed to an increase in global oil supply, which has reduced OPEC's relative market share and weakened its traditional ability to control the global oil market.

Third Topic: Estimating and Analyzing the Impact of Shale Oil on OPEC's Share in the Global Market

This applied aspect aims to analyze and measure the impact of shale oil production in the United States, along with the global price of oil, global oil demand, and supporting structural variables on the share of the Organization of the Petroleum Exporting Countries (OPEC) in global oil production, using annual data covering the period 2000-2024. The importance of this analysis comes

in light of the profound structural transformations that the global oil market has witnessed over the past two decades, especially after the great boom in shale oil production, which contributed to increasing supply global oil and reshaping the balance of power between conventional and non-conventional producers. Due to the dynamic nature of the relationship between the variables under study, which is characterized by the overlap of short-term and long-term effects, as well as the possibility of different degrees of integration of the time series used, the Autoregressive Distributed Lag model (ARDL) model has been adopted as the most appropriate standard framework for achieving the research objectives. This model is characterized by its ability to deal with combined variables of orders $I(0)$ and $I(1)$ degrees without the requirement of standardization of the order of integrity, in addition to its suitability for relatively small time samples, which corresponds to the nature of the study data. The ARDL model also allows testing the existence of a long-term equilibrium relationship between variables through the Bounds Tests addition, the model allows the estimation of the Error Correction Model (ECM), which is used to analyze short-term dynamics and measure how quickly OPEC shares return to equilibrium in the event of temporary deviations due to oil shocks or sudden changes in the global market.

Accordingly, in this chapter, stationary tests will be performed for time series to ascertain their statistical properties, then estimate the ARDL model and select the optimal lags based on the AIC Information Standard (AIC), followed by the co-integration test and long-term relationship extraction, then the error correction model and the standard results analysis, and the evaluation of the model quality through diagnostic tests and structural

stability tests, to ensure the integrity of the results and their economic interpretation.

First: Description of the study variables:

The study relied on a set of economic variables related to the development of shale oil production and its impact on the share of the Organization of the Petroleum Exporting Countries (OPEC) in global oil production during the period (2000-2024), as these variables were selected based on the economic literature related to global energy markets and structural transformations in the oil market. The variables were as follows:

The dependent variable (LN_OPEC_SHARE) is representative of OPEC's share of global oil production, and is measured as a percentage of the total global oil production after taking its natural logarithm in order to reduce variability and improve the characteristics of the time series. The first independent variable (LN_BRENT) represents the global price of crude oil based on Brent crude as the main benchmark index in global oil markets, and the natural logarithm of the chain has been used to stabilize and reduce data dispersion. The relationship between oil prices and OPEC's share is expected to be positive, as higher prices support the ability of member countries to increase production and maintain their market share. While the variable (LN_DEMAND) represents the global demand for oil, and is measured by the volume of global consumption of crude oil and its derivatives in million barrels per day after converting it to the natural logarithm. The relationship is expected to be positive, as rising global demand leads to an increased need for conventional oil supplies.

The variable (LOGSHALESARE) expresses the share of shale oil in global oil production, and measures the extent to which shale oil's contribution to international oil markets has escalated. The relationship with

OPEC's share is expected to be negative, as the expansion of shale oil production leads to an increase in global oil supply and a reduction in the market influence of OPEC member countries. The variable (LN_RENEWABLE) which represents renewable energy, and expresses the share or consumption of renewable energy sources globally after taking its natural logarithm. The relationship is expected to be negative, as the expansion of the use of renewable energy reduces the relative dependence on crude oil as a major source of energy. Through these variables, the study seeks to analyze the nature of the relationship between the development of shale oil production and the transformations in the structure of the global oil market, and the extent to which this is reflected on the market share of OPEC during the study period.

Second: ARDL Study Model and Formulating Equations:

The econometric model of the study is based on the analysis of the impact of the share of shale oil in world production, crude oil prices, global oil demand, and renewable energy on OPEC's share of global oil production during the period 2000-2024. The indicative relationship can be formulated as follows:

$$LN_OPEC_SHARE_t = f(LN_BRENT_t, LN_DEMAND_t, LOGSHALESARE_t, LN_RENEWABLE_t)$$

The long-term formula takes the following formula:

$$LN_OPEC_SHARE_t = \beta_0 + \beta_1 LN_BRENT_t + \beta_2 LN_DEMAND_t + \beta_3 LOGSHALESARE_t + \beta_4 LN_RENEWABLE_t$$

The general ARDL model is written as follows:

$$\begin{aligned}
& \Delta LN_OPEC_SHARE_t \\
& = \alpha_0 + \Sigma \alpha_1 \Delta LN_OPEC_SHARE_{t-i} \\
& + \Sigma \alpha_2 \Delta LN_BRENT_{t-i} \\
& + \Sigma \alpha_3 \Delta LN_DEMAND_{t-i} \\
& + \Sigma \alpha_4 \Delta LOGSHALESHARE_{t-i} \\
& + \Sigma \alpha_5 \Delta LN_RENEWABLE_{t-i} \\
& + \lambda_1 LN_OPEC_SHARE_{t-1} \\
& + \lambda_2 LN_BRENT_{t-1} + \lambda_3 LN_DEMAND_{t-1} \\
& + \lambda_4 LOGSHALESHARE_{t-1} \\
& + \lambda_5 LN_RENEWABLE_{t-1} + u_t
\end{aligned}$$

After the co-integration of the variables is established through the boundary test, the ECM error correction model is estimated as follows:

$$\begin{aligned}
& \Delta LN_OPEC_SHARE_t \\
& = \gamma_0 + \Sigma \gamma_1 \Delta LN_OPEC_SHARE_{t-i} \\
& + \Sigma \gamma_2 \Delta LN_BRENT_{t-i} \\
& + \Sigma \gamma_3 \Delta LN_DEMAND_{t-i} \\
& + \Sigma \gamma_4 \Delta LOGSHALESHARE_{t-i} \\
& + \Sigma \gamma_5 \Delta LN_RENEWABLE_{t-i} + \phi ECM_{t-1} \\
& + u_t
\end{aligned}$$

ECMt-1 represents the error correction threshold that measures the speed of OPEC's share returning to its long-term equilibrium position after any short-term shock or imbalance. This limit coefficient must be negative and statistically significant to confirm the existence of a correction mechanism towards equilibrium.

The expected signals for transactions are as follows:

- Rising oil prices support OPEC share = $\beta_1 > 0$
- Increased global oil demand leads to a rise in OPEC share = $\beta_2 > 0$
- Rising share of shale oil in global production leads to decline in OPEC's share = $\beta_3 < 0$
- Expansion of renewable energy reduces reliance on conventional oil

and thus puts pressure on OPEC's share = $\beta_4 < 0$

Third: Stability Test - Unit Root - ADF:

The results of the Augmented Unit Root Test (ADF) in Table (2) showed that most of the study variables were unstable at the level (Level), as it turned out that the variables of OPEC's share of world production (LN_OPEC_SHARE), crude oil prices (LN_BRENT), global oil demand (LN_DEMAND), and share of shale oil (LOGSHALE)) carried the roots of unity at the level, because the probability values associated with it were higher than the level of significance (5%). However, these variables became stable after taking the first difference, as the probability values decreased to less than (5%), indicating their integration of the first order I(1).

In contrast, the renewable energy variable (LN_RENEWABLE) showed stability at the level directly, which means that its integration is from zero degree I(0). Thus, it is clear that the study variables are distributed between variables stable at the level and stable variables at the first difference, which makes the ARDL model suitable for standard analysis, due to its ability to deal with mixed variables between I(0) and I(1) Without the need to standardize the degree of integration between all variables.

Table 2: ADF Time Series Test (Unit Root) For The Period (2000-2024)

Variable	Level (I,0)			First Level Difference (I,1)		
	Statistics	Results	P. value	Statistics	Results	P. value
In-opec-share	0.414907	Non-Stationary*	0.9793	-4.00454	Stationary*	0.0057
In. brent	-1.932208	Non-Stationary*	0.3129	-4.25249	Stationary*	0.0034
In. demand	-0.83105	Non-Stationary*	0.7883	-5.90089	Stationary*	0.0001
loggshale	-1.88253	Non-Stationary*	0.3340	-4.50902	Stationary*	0.0021
In-renewable	-4.705773	Stationary*	1.0000	-	-	-

* Refers to the fixed limit Intercept.
 • Source: Prepared by the researcher based on the outputs of EViews 12.

Fourth: Co-integration Test:

Table (3) ARDL-BOUNDS Test for long-Run Cointegration (2000-2024)

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	6.385683	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Finite Sample: n=35				
Actual Sample Size	24	10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532
Finite Sample: n=30				
		10%	2.525	3.56
		5%	3.058	4.223
		1%	4.28	5.84

SOURCE: EViews 12 OUTPUT

The results of the Bounds Test of the ARDL model in Table (3) indicate that there is a long-term equilibrium relationship between the variables included in the model, represented by OPEC's share of global oil production, the variables of the global oil price, the global demand for oil, renewable energy, and the share of shale oil in the global production. The statistical value (F-statistic) calculated was about (6.385683), which is higher than all the critical values of the upper limit (I) (1) At the levels of significance (10%, 5%, 2.5%, and 1%) respectively (3.09, 3.49, 3.87, and 4.37). This means rejecting the null hypothesis that there is no long-term equilibrium relationship

between variables, and accepting the alternative hypothesis that they are mutually integrated.

This result reflects a stable structural correlation between OPEC's share and explanatory variables during the study period (2000–2024), suggesting that changes in the share of shale oil, renewable energy, global demand and oil prices are not only temporary, but also have long-term effects on OPEC's market share in the global oil market. The result also shows that the ARDL model used is statistically appropriate for analyzing the relationship between variables, which allows for a transition to estimating term coefficients. The long-term and error correction model (ECM) to analyze the short-term dynamics and the speed of returning to equilibrium after oil shocks or changes in the global market.

Fifth: Analysis of the Long-Term Relationship:

Table (4) Long - Run Estimates Results for the Period (2000-2024)

ARDL Long Run Form
 Dependent Variable: D(LN_OPEC_SHARE)
 Selected Model: ARDL(1, 1, 0, 1, 1)
 Case 2: Restricted Constant and No Trend
 Sample: 2000 2024
 Included observations: 24

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_BRENT	0.000607	0.038856	0.015626	0.9877
LN_DEMAND	1.112031	0.364727	3.048938	0.0081
LOGSHALESARE	0.075820	0.028976	2.616615	0.0194
LN_RENEWABLE	-1.031793	0.173122	-5.959932	0.0000
C	0.882719	1.485153	0.594362	0.5611

SOURCE: EViews 12 OUTPUT

The results of the long-term equation in the ARDL model in Table (4) indicate that there are varying effects of the explanatory variables in OPEC's share of global oil production during the study period (2000-

2024). The results showed that the variable of the global crude oil price (LN_BRENT) came with a positive coefficient of (0.000607), but the high probability value (0.9877) indicates that it is statistically insignificant in the long run, which means that the changes in global oil prices did not have a substantial effect on the explanation of the changes OPEC's market share during the period under consideration. This can be explained by the evolution of shale oil production and structural factors in the oil market becoming more influential than temporary price changes. As for the variable of global oil demand (LN_DEMAND), it recorded a positive and statistically significant coefficient of (1.112010) at a significant level of less than (1%), which indicates that there is a strong direct relationship between global demand and OPEC's share of global production. This means that the rise in global demand for oil strengthens OPEC's role and increases its ability to maintain its market share, given that the countries of the organization have large production capacities that enable them to meet the increase in global demand. On the other hand, the renewable energy variable (LN_RENEWABLE) showed a negative and statistically significant coefficient of (-1.031793), indicating that the expansion of the use of renewable energy sources leads to a decline in OPEC's share of global oil production in the long term. This result reflects structural shifts in global energy markets and the trend of many countries towards reducing dependence on fossil fuels.

The results also showed that the variable of the share of shale oil in global production (logshaleshare) achieved a positive coefficient of (0.075820) and was statistically significant at the level of (5%). This result indicates that

there is a direct relationship between the expansion of shale oil and OPEC's share, a result that may seem contrary to the traditional theoretical expectation. This can be explained by the fact that the increase in shale oil production during some periods was accompanied by the growth of global oil demand and the expansion of the size of the global oil market, which allowed OPEC to continue to maintain its An important part of its production share despite the escalating unconventional oil supply. It may also reflect a strategic response by OPEC to adjust production levels to maintain market balance and not lose its share sharply. Overall, the long-term results confirm that structural factors, particularly global demand, renewable energy, and shale oil, have become highly influential in reshaping the balance of power within the global oil market and in determining OPEC's long-term market share.

Sixth: Analysis of the Short-Term Relationship:

Table (5) Short Term Results (ECM) for the Period (2000-2024)

ARDL Error Correction Regression
 Dependent Variable: D(LN_OPEC_SHARE)
 Selected Model: ARDL(1, 1, 0, 1, 1)
 Case 2: Restricted Constant and No Trend
 Sample: 2000 2024
 Included observations: 24

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_BRENT)	0.034945	0.010747	3.251480	0.0054
D(LOGSHALESARE)	-0.127441	0.029553	-4.312321	0.0006
D(LN_RENEWABLE)	0.268046	0.140379	1.909446	0.0755
CoIntEq(-1)*	-0.541002	0.075692	-7.147410	0.0000
R-squared	0.794909	Mean dependent var		-0.008722
Adjusted R-squared	0.764145	S.D. dependent var		0.029465
S.E. of regression	0.014310	Akaike info criterion		-5.504750
Sum squared resid	0.004095	Schwarz criterion		-5.308408
Log likelihood	70.05700	Hannan-Quinn criter.		-5.452660
Durbin-Watson stat	2.305453			

SOURCE: EVIEWS 12 OUTPUT

The results of the error correction model (ECM) in Table (5) indicate the existence of short-term effects of explanatory variables in OPEC's share of global oil production during the study period, as well as the existence of a correction mechanism that restores balance to the long-term relationship after the occurrence of temporary shocks or deviations in the oil market. The results showed that the global crude oil price variable $D(LN_BRENT)$ It achieved a positive coefficient of (0.034945) and was statistically significant at a level of less than (1%), as the probability value reached (0.0054). This indicates that higher oil prices in the short term contribute to boosting OPEC's share of global production, given the ability of OPEC countries to benefit from higher prices by increasing revenues and improving production levels. The renewable energy variable $D(LN_RENEWABLE)$ recorded a positive coefficient of (0.268046), but its statistical significance was limited to (10%) only, with a probability value of (0.0755). This result can be explained by the fact that the impact of renewable energy in the short term is still relatively limited, due to the continued reliance of the global economy on conventional oil and the inability of alternative energy to quickly completely replace fossil fuels in short periods.

On the other hand, the variable of the share of shale oil $D(LOGSHALESARE)$ showed a negative and statistically significant coefficient of (-0.127441) at a significant level of less than (1%), which indicates that the rapid expansion of shale oil production leads to a decline in OPEC's share of global oil production in the short term. (-1) It reached (-0.541002) and was negative and statistically significant at the level of (1%), which is an

important signal that confirms the existence of a long-term equilibrium relationship between the variables. This means that about 54% of the short-term imbalances affecting OPEC's share are corrected annually and return to the long-term equilibrium path, reflecting a relatively moderate speed in restoring balance within the global oil market after shocks. The results of the model also showed that the coefficient of determination (R^2) reached about (0.7949), i.e., the independent variables explain approximately (79%) of the changes in OPEC's share of global production, which is a good interpretation ratio that reflects the efficiency of the model in interpreting the economic relations under study. The Durban-Watson coefficient was also 2.30, suggesting that there was no serious autobinding problem in the model residues.

Conclusions:

- 1- The results of the border test showed that there is a long-term mutual integration relationship between OPEC's share of global oil production and the explained variables, which confirms the existence of a stable equilibrium relationship over the period of Study.
- 2- The long-term results showed that the global demand for oil has a positive and moral impact on OPEC's share. In other words, increased global demand strengthens the organization's ability to maintain its position in the oil market.
- 3- The results showed that renewable energy has a negative and moral impact on OPEC's share in the long term. This reflects the escalating role of energy alternatives in reducing the relative dependence on conventional oil.

- 4- The short-term results showed that the share of shale oil in the global production has a negative and significant impact in OPEC's share, demonstrating that shale oil is a direct competitor to conventional oil in the Global market.
- 5- The error correction coefficient was confirmed negative and significant, which means that about 54% of the imbalances are short The term is corrected within one year towards long-term equilibrium.
- 6- The results indicate that shale oil is no longer just an additional source of energy, but has become a factor structurally influential in reshaping the balance of supply within the global oil market.
- 7- The study shows that OPEC's ability to influence the market is becoming more closely related to structural shifts in global energy, and not just oil price fluctuations.
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