

Oil Rent and Institutional Quality: Effects on Income Inequalities in Algeria

الريع النفطي وجودة المؤسسات: تأثيراتهما على عدم المساواة في الدخل في الجزائر

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Abstract

This research examines the interplay between oil revenues, institutional governance, and income inequality in Algeria. Using lagged autoregressive models for the period 1980–2022, it uncovers two key findings.

First, the relationship between petroleum revenues and socioeconomic disparities is nonlinear. While initial increases in oil income are associated with reduced inequality, this trend reverses over time as revenues accumulate, potentially widening economic divisions.

Second, the analysis highlights the pivotal role of institutional quality in shaping these outcomes. Strong governance ensures that oil wealth translates into broader societal benefits, whereas weak institutions may exacerbate disparities.

Keywords: Income inequality; Oil rent; Institutional quality; ARDL; Algeria

المخلص

تبحث هذه الدراسة في التفاعل بين العائدات النفطية، والحوكمة المؤسسية، وعدم المساواة في الدخل في الجزائر. باستخدام نماذج الانحدار الذاتي المتباطئ للفترة 1980–2022، وتوصلت النتائج إلى استنتاجين مهمين.

أولاً، العلاقة بين الإيرادات النفطية والتفاوتات الاجتماعية والاقتصادية غير خطية. ففي حين ترتبط الزيادات الأولية في الدخل النفطي بانخفاض عدم المساواة، ينعكس هذا الاتجاه مع مرور الوقت مع تراكم الإيرادات، مما قد يؤدي إلى توسيع الفجوات الاقتصادية. ثانياً، يسلط التحليل الضوء على الدور المحوري لجودة المؤسسات في تشكيل هذه النتائج. فالحوكمة القوية تضمن ترجمة الثروة النفطية إلى منافع مجتمعية أوسع، في حين قد تؤدي ضعف المؤسسات إلى تفاقم التفاوتات.

الكلمات المفتاحية: عدم المساواة في الدخل؛ الريع النفطي؛ جودة المؤسسات؛ نموذج الانحدار الذاتي المتأخر؛ الجزائر؛

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Introduction

The management of revenues from hydrocarbon exploitation and their impact on economic growth has generated extensive literature. Since the Dutch disease theory (Corden & Neary, 1982), numerous studies have examined natural resources, rent, and the resource curse (Gelb, 1988); (Sid-Ahmed, 1989) (Auty, 1994) (Ross, 2001); (Stevens, 2003). However, the effects of oil rent extend beyond the economic sphere, also affecting various aspects of social life, particularly the well-being of the population, due to fluctuations in the oil market (Ekonomie, Assoumou-Ella, & Moussavou-Batemi, 2019). Furthermore, the dependence of economies on oil resources exacerbates household vulnerability, as oil revenues are not equitably distributed (Rosellini, 2005). Research on the impact of oil revenues on inequality shows that oil rent amplifies disparities between the rich and the poor (Ganguly & Das, 2016); (Farzanegan & Krieger, 2019). According to (Mehlum, Moene, & Torvik, 2012), the inequalities linked to oil result from the inequitable distribution of oil resources among households. Institutional quality is often cited as a major cause of this unequal redistribution. (Ndikumana & Boyce, 2012) highlight a strong correlation between oil, poverty, inequality, and institutional quality, particularly concerning corruption.

This study aims to examine the impact of oil rents on income inequality in Algeria, focusing on how governance structures influence the equitable distribution of oil wealth. We hypothesize that the effect of oil rents on inequality is conditioned by the quality of the institutions managing these resources. Specifically, we propose that well-governed institutions can mitigate the negative effects of oil rents on income disparity, while weak institutions may amplify inequalities.

To test this hypothesis, we employ a lagged autoregressive model (ARDL) covering the period from 1980 to 2022, drawing on the empirical framework of (Goderis & Malone, 2011), who analyzed the effect of natural resource booms on income inequality. This approach allows us to capture both short- and long-term dynamics between oil revenues, institutional quality, and income inequality.

The paper is organized into three main sections. The first section reviews the literature on the relationship between oil rents, institutional quality, and social outcomes. The second section presents a descriptive analysis of the data, and the final section outlines the empirical findings and discusses their implications for policy.

1. Literature Review

The neoclassical model's shortcomings in explaining economic growth through only capital and labor contributions prompted economists to explore additional factors. Consequently, growth theory expanded to encompass natural capital, which emerged as a key element in accounting for variations in economic performance across different contexts.

In 1982, Corden and Neary developed the Dutch disease theory to describe the resource curse. This theory suggests that significant oil income often weakens the performance of non-oil sectors, marginalizing key industries such as agriculture and manufacturing, ultimately leaving oil as the dominant source of income. Since then, numerous studies have attempted to establish a negative relationship between

the abundance of natural resources and poor growth performance (Ranis, 1991) ;(Auty, 1993); (Lal & Myint, 1996); (Sachs & Warner, 1995); (Sachs & Warner, 1999); (Auty, 2001). These authors show that resource-rich countries tend to grow more slowly than countries with fewer natural resources. Another dimension of the resource curse lies in its effects on various areas of social life, notably the well-being of the population, poverty rates, and income inequality. (Ekomie, Assoumou-Ella, & Moussavou-Batemi, 2019) demonstrate that petroleum revenues impact societal welfare, with this effect being closely tied to oil market volatility. Moreover, (Rosellini, 2005) argues that a heavy reliance on oil resources can heighten household economic insecurity, as the benefits from these revenues are often unevenly distributed.

Prior research examining the relationship between petroleum revenues and economic disparity indicates that resource wealth may exacerbate income gaps. A study by (Leamer , Maul , Rodrigue, & Schott, 1999) posits that resource exploitation does not require highly specialized skills, which can result in more pronounced and persistent income inequality in these countries. Numerous authors have confirmed the existence of a positive correlation between natural resource rents and inequality ((Stevens, 2003); (Sarraf & Jiwanji, 2001). (Bourguignon & Morrisson, 1998) advocate for the inclusion of resource endowments in income distribution equations. The work of (Gylfason & Zoega, 2002), highlights a potential paradox in resource-rich nations: their findings indicate that an abundance of natural resources might simultaneously hinder economic progress and amplify socioeconomic divisions. (Farzanegan & Krieger, 2019) showed that the oil boom did not reduce inequality in Iraq, findings confirmed by (Gadom, Fondo, & Totouom, 2018) for Chad.

In developing countries, oil tends to exacerbate both horizontal (between groups) and vertical (within groups) inequalities. (Ross, Lujala, & Rustad, 2012) and (Ganguly & Das, 2016) show that a 35% increase in oil prices reduces the earnings of economically vulnerable groups significantly more than those of affluent households, with the impact on low-income families being approximately six times greater. Horizontal inequalities arise when resource distribution aligns with certain national divisions, such as ethnic, religious, or tribal considerations. (Gadom, Fondo, & Totouom, 2018) note that some regions in Chad, although already poor, received a very small share of oil wealth, around 3% each, compared to 13% allocated to less poor regions.

To explain these inequalities, (Mehlum, Moene, & Torvik, 2012) and (Moradi, 2010) mention the inequitable distribution of oil revenues and a failure in redistributing oil wealth. (Parcero & Papyrakis, 2016) argue that oil rent can reduce inequality only through redistribution policies targeting low-income groups. This idea is supported by (Mehlum, Moene, & Torvik, 2012), who suggest that inequalities can be reduced through allocating revenues to social services, particularly health and education. (Gylfason, 2001) found a negative relationship between natural resources and public education spending, arguing that natural resources tend to crowd out other forms of capital, notably human and social capital. However, (Farzanegan & Thum, 2017) observe a notable positive correlation between petroleum revenues and educational access. This finding is corroborated by (James, 2017) in the context of the United States. He shows that teacher salaries in oil-rich US states are higher than in oil-poor states. (Copinschi, 2007)

confirms that, unlike developed countries with substantial oil resources, developing countries dependent on oil revenues reinforce the construction of a rentier state. Hence, the issue is not the dependence on natural resources but the lack of quality institutional frameworks that enable the implementation of adequate policies (Gylfason, 2001).

Some authors propose that the relationship between petroleum wealth and economic disparity is influenced by multiple factors. (Andres & Dobson, 2011) and (Arezki & Brückner , 2011) highlight the significance of governance integrity in resource-abundant nations as one such determining element. In these countries, oil rent does not promote economic development and inequality reduction but rather stimulates power struggles (Copinschi, 2007) . (Ndikumana & Boyce, 2012) affirm the existence of a positive correlation between oil, poverty, inequality, and institutional quality, particularly corruption. (Kolstad, Wiig, & Williams, 2008) show that corruption is a major problem in many developing countries with natural resources, hindering their progress in societal and economic spheres.

(Karl, 2004) posits that nations heavily reliant on petroleum often exhibit systemic issues such as governmental misconduct, ineffective administration, and widespread rent-seeking behaviors. This perspective is echoed in subsequent research. For instance, (Arezki & Gylfason, 2013) demonstrate a positive relationship between resource-derived income and instances of corruption. In the African context, (Omgbu, 2010) 's (2010) analysis reveals an inverse association between oil-based revenues and the efficacy of anti-corruption measures. Additionally, (Arezki & Brückner , 2011) in their study of 30 oil-exporting countries from 1992 to 2005, conclude that petroleum-derived income significantly contributes to the proliferation of corrupt practices.

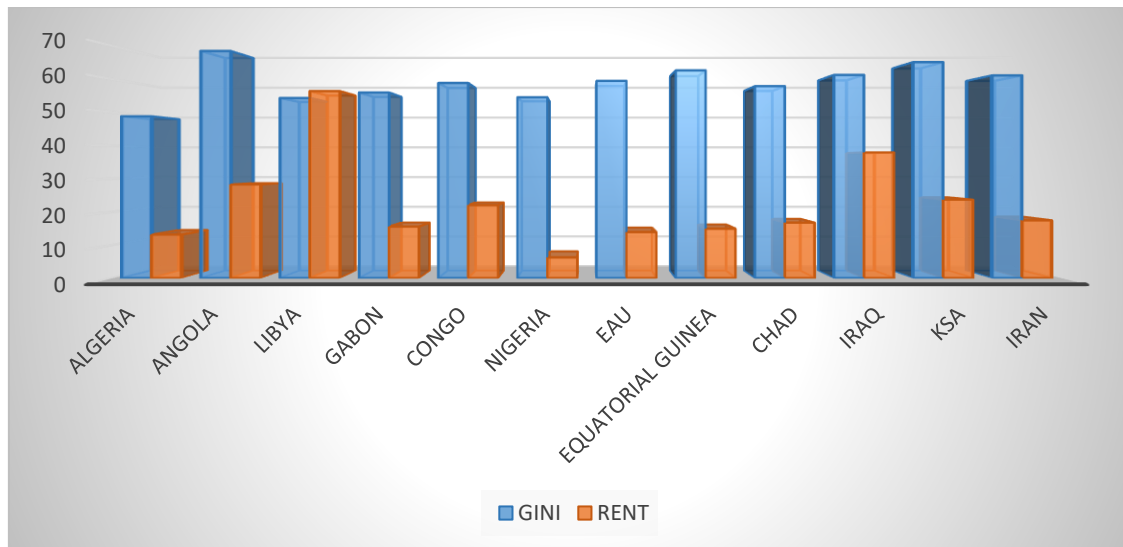
In high-corruption contexts, oil revenues contribute to worsening income inequalities. (Dincer & Gunalp, 2008) reveal that increased corruption leads to a 0.3 percentage point rise in the Gini index and a 0.5 percentage point increase in poverty. (Gupta, Davoodi , & Alonso-Terme , 2002) indicate that a standard deviation increase in corruption raises income inequality by about 11 percentage points. (Gyimah-Brempong & de Gyimah-Brempong , 2006) demonstrates that a significant decrease in corruption substantially enhances economic growth, with slightly more pronounced effects observed in African nations compared to Latin American countries. Their research further indicates that a measurable reduction in corrupt practices correlates with a noticeable improvement in income distribution, as reflected by the Gini index, with Latin American countries showing a marginally greater benefit in this aspect.

In conclusion, this review demonstrates that oil rents have complex and varied impacts on inequality and economic growth. Improving the quality of institutions and implementing appropriate redistribution policies appear to be crucial solutions to mitigate these effects and promote more equitable economic development.

2. Descriptive Analysis

This segment aims to explore the interconnections among petroleum revenues, governance effectiveness, and economic inequality through an analytical overview.

Figure (1): Gini Index and Oil Rent in 2021



Source: Created by the author using Excel (2016)

An examination of the visual data indicates a complex relationship between income inequality, measured by the Gini index, and economic dependence on oil revenues as a percentage of total GDP. Countries like Angola, Iraq, and Libya exhibit relatively high Gini indices, indicating significant income disparities. These countries also show a strong dependence on oil rent, suggesting that revenues from this source may exacerbate economic inequalities. In contrast, countries like the United Arab Emirates (UAE) and Saudi Arabia (KSA) demonstrate moderate inequality levels despite substantial reliance on oil rent. This could be attributed to specific economic and social policies influencing the distribution of oil-generated wealth.

Algeria stands out in this analysis with a Gini index of 48.8 and a moderate dependence on oil rent, accounting for approximately 13.1% of GDP in 2022. These figures indicate relatively high inequality compared to some Gulf countries like the UAE and KSA, which have lower Gini indices despite similar or higher reliance on oil rent. This suggests that other economic and social factors play a significant role in wealth distribution in Algeria, alongside oil revenues.

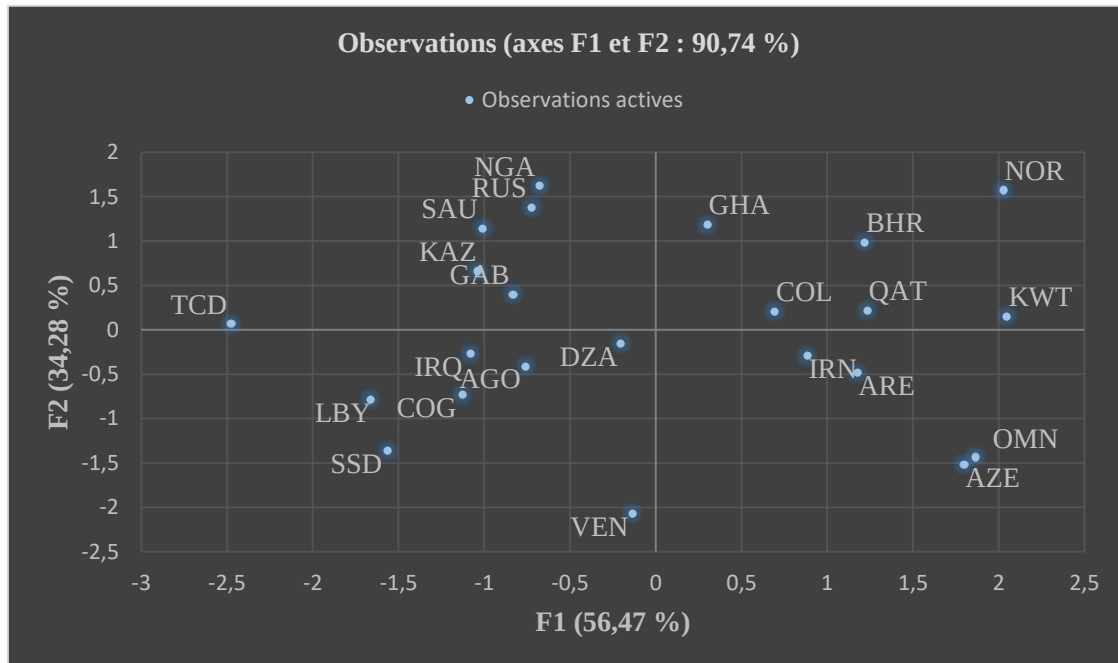
To deepen our analysis, we will conduct a Principal Component Analysis (PCA) for a sample of 23 oil-rich countries (Algeria, Angola, Saudi Arabia, Azerbaijan, Bahrain, Chad, Colombia, the Republic of Congo, Gabon, United Arab Emirates, Ghana, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, South Sudan, Venezuela). To facilitate our analysis, we will employ data from the most recent iteration of the "Institutional Profiles Database", specifically the 2016 edition[†]. We have selected three indicators (quality of the institutional framework, governance of natural resources, and income disparity). These indicators are constructed based on positively correlated variables, a necessary condition for aggregation (Meisel & Ould Aoudia, 2007). Then, the aggregation of the variables is carried out by an unweighted arithmetic mean, which

[†] The "Institutional Profiles Database" (IPD) is one of the richest databases measuring institutional quality. It provides an original measure of institutional characteristics of countries through composite indicators based on perception data. It was designed to facilitate and stimulate research on the relationship between institutions, long-term growth, and development. The IPD 2016 database builds on the continuity of versions from 2001, 2006, 2009, and 2012. It covers 144 countries and includes 127 indicators.

allows for maximum transparency and enhances the clarity of the resulting metrics, as suggested in the (OECD, 2008) guidelines. The variables used for constructing our eight indicators are provided in Appendix 1.

The principal component analysis reveals that the first factor accounts for 56.47% of the total variance and is associated with variables concerning the quality of institutional frameworks and the governance of natural resources. Meanwhile, the second factor explains 34.28% of the variance and is associated with income inequality.

Figure (2): Principal Component Analysis



Source: Created by the author using XLSTAT from the IPD 2016 database

The analysis of Figure 2 shows that among all the oil-producing countries, Norway stands out for its high-quality institutional framework and good governance of natural resources. This favorable position is illustrated by its placement on the far right of the graph. Norway benefits from strong democratic institutions, transparent policies, and a well-structured resource management system, contributing to more equitably distributed income.

In contrast, countries such as Venezuela, Chad, and South Sudan are situated at the extreme left of the chart, indicating poor natural resource governance and low-quality institutions. These countries also exhibit significant income disparities, as reflected by their proximity to the income disparity axis. Issues such as corruption, poor resource management, and political instability explain this position. For example, Venezuela has suffered from severe economic crises, poor management, and ineffective government policies, leading to significant inequalities and poor governance.

Other countries like Algeria, Angola, and Iraq are found in the lower-left quadrant, indicating lower quality institutions and rather poor natural resource governance, but with moderate income disparities. These countries often face challenges such as corruption, weak democratic institutions, and excessive dependence on oil revenues, limiting their ability to equitably redistribute wealth.

Gulf countries like Kuwait and Qatar are positioned in the upper-right quadrant,

indicating better institutional quality and good natural resource governance, but relatively high income disparity. Although these countries have relatively strong institutions and effective resource management, they face significant inequalities, often due to restrictive citizenship policies and the presence of a large population of migrant workers with limited rights.

Finally, countries like Kazakhstan, Russia, and Nigeria, located in the upper-left quadrant, show intermediate institutional quality and natural resource governance with moderate to high income disparities. These countries have institutions that function variably and resource governance that is not always effective. For example, in Russia and Kazakhstan, despite efforts to improve resource management, problems of corruption and authoritarian governance persist, influencing income inequalities.

Overall, this analysis highlights a relationship between the quality of institutions, natural resource governance, and income disparities in oil-producing countries. Countries with better institutions and more transparent resource management tend to have less pronounced income inequalities, while those with weaker institutions and poor resource management see greater inequalities.

3. Empirical Analysis

We investigate the correlation among oil revenue, institutional integrity, and income disparity in this section. We perform an empirical investigation utilizing Autoregressive Distributed Lag (ARDL) models. This work takes inspiration from the study by (Goderis & Malone, 2011) which investigated the impact of natural resource booms, especially oil, on income inequalities both theoretically and empirically. However, our approach diverges from their research methodology. Instead of relying on the export price index as a proxy for resource wealth, we opt to examine the percentage of GDP attributed to oil revenues. This specification is complemented by a set of control variables commonly used in macroeconomic inequality equations (Chong & Calderón, 2000); (Andres & Dobson, 2011). In this context, we consider institutional quality, trade openness, demographic effects represented by population size, human capital, and unemployment rate. Our baseline model takes the following form.

$$Gini_t = \alpha_i + \beta_1 Gini_{t-1} + \beta_2 Rent_t + \beta_3 Inst_t + \beta_4 HK_t + \beta_5 Pop_t + \beta_6 Trade_t + \beta_7 UR_t + \varepsilon_{it} \dots\dots(1)$$

Where t ranges from 1980 to 2022

In this equation: α represents the constant, Gini denotes the income inequality index, Ginit-1 is the lagged Gini index, Rent refers to oil rent as a percentage of GDP, Inst indicates institutional quality, Hk stands for human capital, Pop represents population size, Trade signifies trade openness, UR is the unemployment rate, and ε denotes the error term.

3.1 Data Used

We have chosen the Gini index as the endogenous variable to measure income inequalities. The data used come from the World Income Distribution database (WID, 2023).

The variables of interest are oil rent, which corresponds to petroleum income as a percentage of GDP, and the effectiveness of institutional structures, measured by a

composite indicator derived from synthesizing three variables: government size, legal structure and property rights security, and regulation. These variables range from 0 to 10 (with 0 indicating very poor institutional quality and 10 indicating very high institutional quality). They are sourced from the Economic Freedom of the World database (2023). In addition to the two variables mentioned above, we consider other control variables often cited in the literature as determinants of income inequalities. We include human capital (HK), which is assessed through the average number of years of schooling according to Barro and Lee (2013), as well as the educational return rate derived from the Mincer equation estimates (Mincer, 1974); (Murphy & O'Reilly, 2019); (Bruns & Ioannidis, 2020).

We additionally incorporate variables such as population size (POP), trade openness (Trade), measured by the sum of imports and exports as a proportion of GDP, and the unemployment rate (UR). The data come from the World Bank database (2023), except for human capital and population size, which are drawn from the Penn World Table (version 10.01). The annual data on the variables defined above cover the period from 1980 to 2022.

The ARDL model for equation (1) is written as:

$$\Delta LGINI_t = \alpha_0 + \sum_{i=1}^{p_1} \beta_i \Delta LGINI_{t-i} + \sum_{i=0}^{p_2} \gamma_i \Delta LRENT_{t-i} + \sum_{i=0}^{p_3} \delta_i \Delta LINST_{t-i} + \sum_{i=0}^{p_4} \lambda_i \Delta LHK_{t-i} + \sum_{i=0}^{p_5} \theta_i \Delta LPOP_{t-i} + \sum_{i=0}^{p_6} \omega_i \Delta LTRADE_{t-i} + \sum_{i=0}^{p_7} \varphi_i \Delta LUR_{t-i} + \pi_1 LGINI_{t-1} + \pi_2 LRENT_{t-1} + \pi_3 LINST_{t-1} + \pi_4 LHK_{t-1} + \pi_5 LPOP_{t-1} + \pi_6 LTRADE_{t-1} + \pi_7 LUR_{t-1} + \varepsilon_t \dots (2)$$

3.2 Stationarity Analysis

When using a time series in an ARDL model, it is essential to examine the stationarity of the selected variables before any econometric analysis. This step is essential to avoid misleading results and to verify that none of the variables exhibit second-order integration. It is also important because the ARDL method requires that all variables be integrated at either level or first difference. If any variable is found to be I(2), the F-statistics calculated, as provided by (Pesaran, Shin, & J. Smith, 2001), would no longer be valid. Table 1 displays the outcomes of the ADF test.

Table (1): ADF test results

Variables	Level ADF results		first difference ADF results	Conclusion
	ADFc	ADFt 5%	ADFc	
LGINI	2.08	-1.94	-3.73	Stationary in first difference, arising from a DS process without drift
LRENT	-2.78	-2.94	-5.29	Stationary in first difference, arising from a DS process with drift
LIINST	0.77	-1.94	-6.39	Stationary in first difference, arising from a DS process without drift
LHK	-1.98	-1.94	/	Stationary at level, arising from a DS process without drift.
LPOP	-4.31	-2.93	/	Stationary at level, arising from a DS process with drift

LTRADE	-0.18	-1.94	-6.16	Stationary in first difference, arising from a DS process without drift
LUR	-1.00	-1.95	-4.59	Stationary in first difference, arising from a DS process without drift

Source: Produced by the author using Eviews 13

The ADF tests reveal that all series are integrated of order one (I(1)), except for the variable related to population size. It is crucial to note that none of the series in our analysis is integrated of order two, which is a required for the ARDL methodology.

3.3 Cointegration Test

Conducting the bounds cointegration test as outlined by (Pesaran, Shin, & J. Smith, 2001) requires determining the optimal lag beforehand. The Akaike Information Criterion (AIC) indicates the optimal model as (1, 2, 1, 0, 2, 2, 1).

Table (2): Cointegration Test

Variables			LGINI, LRENT, LINST, LHK, LPOP, LTRADE, LUR
Calculated F-statistic			5.22
Critical Threshold	Lower Bound		Upper Bound
1%	3.976		5.691
5%	2.794		4.148
10%	2.334		3.315

Source: Produced by the author utilizing Eviews 13

Table (2) presents the results of the bounds cointegration test, which reveal a cointegration relationship among the series analyzed. Specifically, the F-statistic value (5.22) exceeds the upper bound value (Bound II = 4.14) at a 5% significance level. This result leads us to reject the null hypothesis of no long-term relationship.

3.3 Toda-Yamamoto Causality Test

When non-stationary variables are not cointegrated or are integrated at different orders, the traditional Granger causality test becomes ineffective. In such cases, the Toda-Yamamoto (1995) causality test is employed, which is based on the "Wald" statistic distributed as chi-square (χ^2). The null hypothesis stipulates the absence of causality between variables (probability $\chi^2 > 5\%$).

Table (3): Toda-Yamamoto Causality Test

Dependent variable LGINI	Independent variables					
	LRENTE	LINST	LHK	LPOP	LTRADE	LUR
Calculated statistic	33.66	24.62	19.95	40.00	7.36	14.95
Probability	0.000	0.000	0.0002	0.000	0.0611	0.0019

Source: Produced by the author utilizing Eviews 13

The results of the Toda-Yamamoto causality test indicate that oil rent, institutional quality, human capital, population size, and unemployment rate have a notable impact on income inequality, with significance at the 1% level.

3.4 ARDL Model Parameter Estimates

Table (4) presents the estimation results for the two ARDL models: ARDL (1, 2, 1, 0, 2, 2, 1) and ARDL (1, 2, 1, 1, 0, 2, 0, 1).

Table (4): ARDL Model Estimation outcomes (Long-term Relationship)

Variables	Linear model	Nonlinear model
LRENT	-0.0029 (-1.85)***	-0.018089 (-3.27)*
RENT²		0.092.35 (3.92)*
LINST	-0.3065 ((-2.79)**	-0.755016 (-3.66)*
LHK	-1.9454 (-2.65)**	-0.980032 (-6.17)*
LPOP	1.2825 (2.14)**	0.520189 (4.25)***
LTRADE	0.0066 (0.96)	0.005341 (2.05)*
LUR	0.1035 (2.45)**	0.058837 (8.92)*
C	-22.29 (-2.19)**	-7.615178 (-3.62)*
CointEq(-1)*	-0.5036 (7.9178)*	-0.979006 (-16.04)*
R²	0.81	0.91
Fc	11.58	32.52
N	30	30

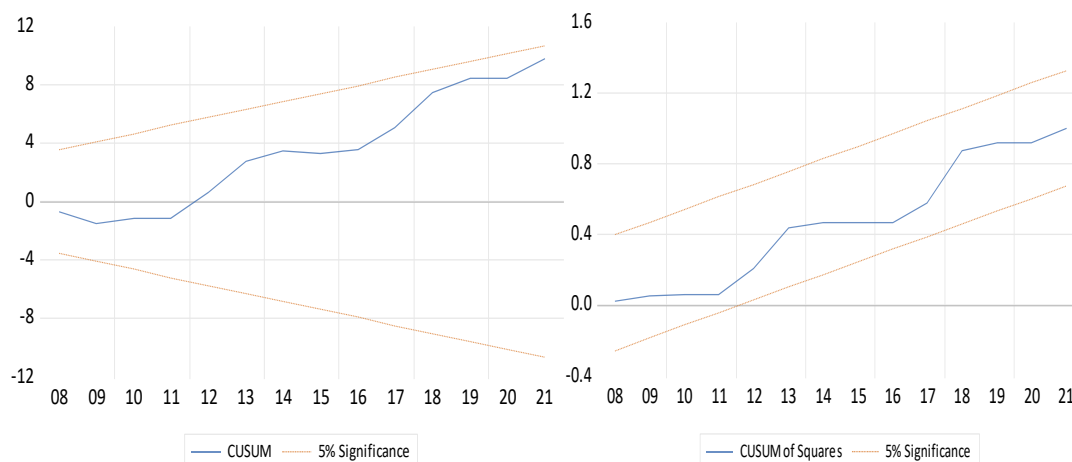
Source: Produced by the author utilizing Eviews 13

* 1% significance level; ** 5% significance level; *** 10% significance level

3.5 Econometric model validation

The CUSUM test, which examines the behavior of forecast errors, assists in detecting structural changes in regression equations over time, thereby aiding in the assessment of model stability.

Figure (3): Model Stability Testing: CUSUM and CUSUM of Squares



Source: Produced by the author utilizing Eviews 13

The CUSUM test reveals that the cumulative residuals remain within the 5% critical boundaries, indicating stability in the model's coefficients. Tests conducted on the residuals (Table 4) confirm that they are homoskedastic (White test), stationary, and show no serial correlation (LM test for error term independence). The error correction term coefficient is negative (-0.50) and statistically significant, suggesting the existence of an error correction mechanism and a long-term relationship between the variables. Therefore, any short-term discrepancies in the GINI index variable will be corrected within approximately two years. Hence, any short-term imbalances in the GINI index variable will be corrected within approximately two years.

Table (4): Diagnostic Test for the Model

Test statistics	Tests	P-value
Autocorrelation	Breusch-Godfrey	0.1529
Heteroscedasticity	Breusch-Pagan-Godfrey	0.2865
Residual Normality	Jarque-Bera	0.7424

Source: Produced by the author utilizing Eviews 13

4. Discussion of the results

Two specifications were utilized, starting with the linear model estimation, whose results are shown in the table's first column. The coefficient for oil rent is statistically significant at the 10% level, showing a negative effect. More precisely, a 1% rise in oil rent leads to a reduction in inequality by 0.029 points. This outcome is consistent with the findings of (Goderis & Malone, 2011), who attribute this adverse impact to the combined effects of increased expenditure and labor mobility. During the initial phases of oil extraction, less skilled workers shift from labor-intensive, low-paying sectors to the burgeoning oil sector, where wages are higher on average. Concurrently, augmented government spending on social welfare enhances access to essential services. However, the negative impact of oil revenues remains significant only up to a certain threshold, beyond this threshold, a rise in income inequality is noticeable. The second set of results (column 2) confirms the notion that the relationship between oil rent and income inequality is non-linear. These findings confirm those of (Goderis & Malone, 2011), who showed that shortly after a resource boom, income inequality decreases, followed by a gradual increase as economic growth progresses, until the initial effect of the boom on inequality fades. These results are consistent with the conclusions of (Gylfason & Zoega, 2002), who argue that a heavy dependence on natural resources leads to significant inequality and low growth. Additionally, they corroborate the work of (Buccellato & Mickiewicz, 2009), which suggests that inequalities are due to flawed oil rent distribution policies that do not consider population density and well-being.

Our results highlight that improving institutional quality leads to a reduction in income inequality. This observation aligns with the conclusions of (Gupta, Davoodi, & Alonso-Terme, 2002) and (Dincer & Gunalp, 2008) who emphasize that quality institutions promote the reduction of income disparities. These disparities can be mitigated through more effective social spending and pro-poor tax systems (Martini & Wickberg, 2014).

Furthermore, in column 2, we observe the findings concerning the interaction between institutional quality and oil rent. This integration aims to evaluate how oil rent affects income inequality in conjunction with institutional factors. The estimation results show a negative and significant coefficient for the interaction term (interaction of oil rent with institutions), indicating that the reduction in income inequality due to oil wealth is conditioned by the quality of institutions. In other words, a high oil rent reduces inequality only if it is supported by strong and effective institutions.

Our findings also confirm that human capital, may play a role in alleviating inequality. This conclusion is consistent with the research of (Yang & Qiu, 2016), (Odusola, Lal, Dhliwayo, & Sabo, 2017), and (Yang & Gao, 2018), who demonstrate an inverse correlation between education and inequality. These studies suggest that inequalities can be reduced by effectively integrating well-educated individuals into

income redistribution mechanisms through employment.

Regarding trade openness, our analysis reveals a non-significant coefficient in the first estimation and a significantly positive coefficient in the second. This result can be explained by the country's increased dependence on oil exports, limiting economic diversification and the distribution of commercial benefits. Furthermore, ineffective institutions and inadequate redistribution policies prevent the equitable distribution of trade gains.

Finally, the positive effect of population size and unemployment on income inequality can be explained by several interconnected factors. Rapid population growth exerts pressure on available resources, including employment and social services, which can lead to wage stagnation or decline, exacerbating inequalities. High unemployment widens the gap between the incomes of workers and the unemployed, as an excess labor supply reduces workers' bargaining power, concentrating income among those with stable and well-paying jobs.

Conclusion

This study highlights the complex relationship between oil rents, institutional quality, and income inequality in Algeria. The findings demonstrate a nonlinear connection between oil rents and income inequality. Initially, higher oil revenues appear to reduce inequality, but this effect diminishes and eventually reverses as oil rents continue to grow, signaling a more pronounced disparity in income distribution over time.

A crucial implication of our analysis is that the reduction in income inequality associated with oil rents is highly contingent upon the quality of institutions. This suggests that while oil wealth has the potential to alleviate inequality, its impact is only realized when supported by strong, effective institutions. In other words, good governance is essential in ensuring that the benefits of oil wealth are distributed equitably across society.

Our results reinforce the importance of focusing on institutional reforms alongside the management of oil revenues. Policymakers in resource-rich countries, such as Algeria, should prioritize strengthening institutional frameworks—particularly in areas of governance, transparency, and social spending—to ensure that the advantages of oil wealth are broadly shared, rather than concentrating wealth in the hands of a few.

Moreover, the findings suggest several concrete policy recommendations:

1. **Strengthen governance and institutional frameworks:** Effective institutions are crucial to managing oil revenues and ensuring they benefit society equitably. Policymakers should focus on enhancing governance to ensure that the revenues from oil are used effectively for the public good, with transparent and accountable mechanisms in place.
2. **Improve fiscal and social policies:** The results emphasize that income inequality can be mitigated through better social spending and progressive tax systems. Reforming fiscal policies to ensure that oil wealth is distributed more equally among the population, especially targeting vulnerable groups, would help reduce inequality.

3. **Encourage economic diversification:** Given the negative effects of heavy dependence on oil, policies should promote economic diversification. Reducing the reliance on oil and investing in other sectors of the economy would help address the root causes of rising inequality and promote sustainable development.
4. **Invest in human capital:** The study highlights the importance of education and skills development in reducing inequality. By investing in education and vocational training, the government can integrate a well-educated workforce into the economy, thus promoting more equitable income distribution.

These recommendations build upon the results of this study and underscore the importance of robust institutional frameworks for managing oil wealth in a way that reduces inequality. The findings contribute to the broader discourse on the resource curse by challenging the notion that natural resource wealth inherently leads to increased inequality. Instead, our study emphasizes the critical role institutions play in shaping the outcomes of resource wealth. Future research should further investigate how institutional quality influences the impact of oil rents on inequality in other resource-dependent nations, considering a broader range of factors that may affect this relationship.

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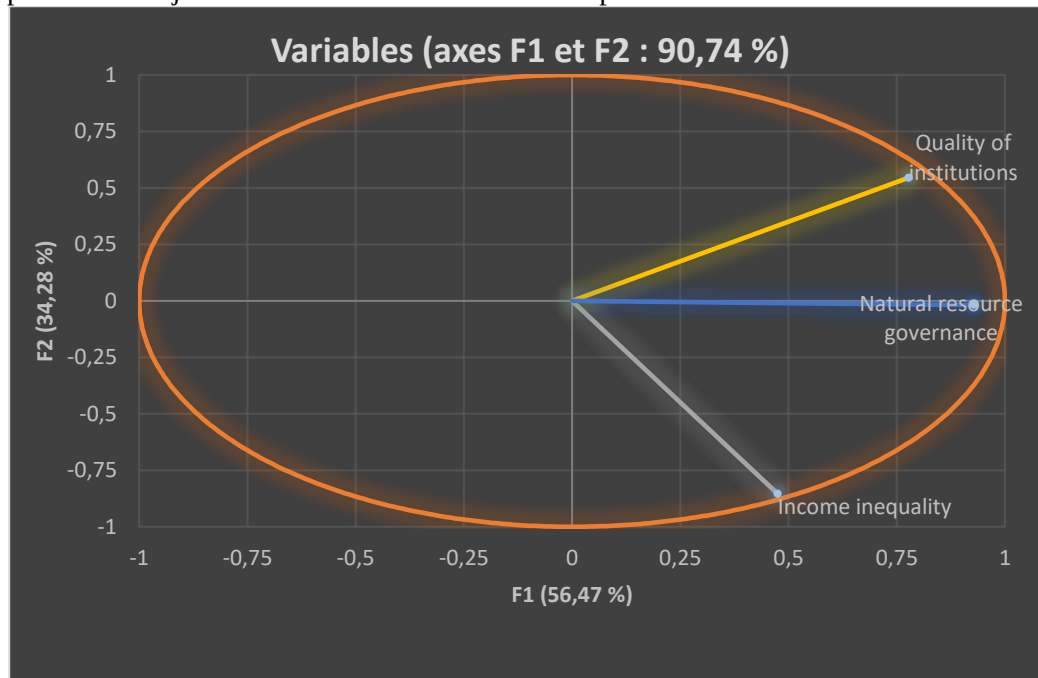
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-Appendices

Appendix 1 : Projection of indicators on the factorial plane



Source: Created by the author using XLSTAT from the IPD 2016 database