The Impact of Oil Price Fluctuation on Public Expenditures in Algeria -Econometric Study-

أثر تقلبات أسعار النفط على النفقات العمومية في الجزائر –دراسة قياسية–

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Abstract:

This research aims to study the impact of oil prices fluctuation on public expenditures as a phenomenon in Algeria within the period 1986 to 2020. To reach the objectives of the research work, annual data and the Angel-granger Approach for testing cointegration relationship were employed.

The study concluded that there is a long-run and a short-run correlation between oil prices and public expenditures. In fact, the higher the price of oil is, the higher the public expenditures and the same in the case of oil price collapse; this applies with the economic rent. In addition, there is a positive relationship in the short-run and therefore the reduction of oil prices has a negative effect on the national economy. This is what has been recently observed in the Government's austerity policies and the rationalization of expenditures.

Keywords: Oil price; Public Expenditures; Angel-Granger; Algeria.

JEL Classification Codes: H27; Q43.

ملخص:

يهدف هذا البحث إلى دراسة تأثير تقلبات أسعار النفط على النفقات العمومية في الجزائر خلال الفترة الممتدة من 1986 إلى 2020 و للوصول إلى أهداف البحث تم استخدام منهجية أنجل قرنجر لاختبار علاقة التكامل المشترك.

توصلت الدراسة إلى وجود علاقة طويلة الأجل وقصيرة الأجل بين أسعار النفط والنفقات العمومية : كلما ارتفعت أسعار النفط، ارتفعت النفقات العمومية ونفس الشيء في حالة انهيار أسعار النفط، وهذا ما ينطبق على الاقتصاد الريعي .توصلنا أيضا إلى وجود علاقة إيجابية على المدى القصير مما يفسر أن انخفاض أسعار النفط له تأثير سلبي على الاقتصاد الوطني .وهذا ما لوحظ مؤخرا في سياسات الحكومة المتعلقة بالتقشف وترشيد النفقات.

كلمات مفتاحية: أسعار النفط.، النفقات العمومية، أنجل قرنجر، الجزائر.

تصنيفات JEL: H27، Q43.

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INTRODUCTION:

Countries that depend on oil revenues as a primary source of their national income are considered as rentier-economy countries. Consequently, they acquire this source and monopolize the legality of owning, distributing and selling it. Additionally, they do not process and transform it, i.e. these revenues are external and not productive, and when oil revenues constitute the only source of rent in an oil country, it leads to the creation o
f secondary rent income through public expenditure programmes.

Obviously, the hydrocarbons sector is the most important economic sector in Algeria for many reasons. Firstly, it is the only source of income generation as it is the main source of financial flows on which the state relies for the conduct of all social and economic fields. Most importantly, the state's economic programs and policies as well as its budget are built and estimated based on this sector.

However, excessive dependence on oil production to generate income along with the consideration of petroleum taxation as the only financier for the treasury with the absence of diversity in domestic revenues remains a source of concern for successive governments; why? Simply, due to the turmoil in this commodity which is determined by unstable external markets.

Actually, the principal focus of the current study is to treat a contemporary issue and the main concern of successive governments because the turmoil in the energy market and its impact on public expenditures threaten the stability and security of the country. The study also highlights the great need for diversity in sources of income in order to get rid of the rentier economy.

In view of that, the study came to answer the following question:

How public expenditures will be affected in the future in the light of the fluctuations in oil prices in Algeria?

1-Literature Review:

There are several studies tried to explain the effect of oil price fluctuations on public expenditures, we recall the most recent and important ones including:

(El Anshasy & Bradley, 2012)): In an empirical study and through the use of the PMG and GMM estimation methodologies, they examined the role that oil prices play in determining fiscal policy in oil-exporting countries based on panel data for a sample of 16 oil-exporting countries during the period 1972-2010. The results showed that the rise in oil prices significantly affected government spending in the long term, while in the short term government spending rose less than the increase in oil revenues.

(Belqualqua, 2013): The aim of this study was to enhance understanding of the effect of oil price fluctuations on public expenditures aiming to study oil price developments and their repercussions on the general budget of Arab countries from 2000 to 2009. The study indicated that there is a direct relationship when the oil prices increase in the exporting countries; this will positively affects the public budget conditions (revenues and expenditures). However, in the case of a decline in oil prices, there is an inverse relationship in the volume of revenues and expenditures, which increases fears of turning into an economic slowdown and forcing it to follow policies to reverse the economic cycle. In terms of public expenditures, the state should seek to rationalize expenditures and raise their efficiency.

(Bouchlait, 2017): This study was conducted to highlight the problem of public spending in Algeria, which is known for its rentier economy that was shaken by the crisis of fluctuations in oil prices in the global market at the beginning of 2015. Based on the results of this study, it could be concluded that getting rid of the fragile economy in Algeria requires defining clear-cut economic policies which putting the goal of diversifying the economy in its center to move from a rentier economy to a wealth-producing economy.

(Ben Dahman & Rekrak, 2017): The goal of this study was to examine the effect of oil price fluctuations on public expenditures with the aim of determining the nature of the impact of oil price fluctuations on the country's fiscal policy. The researcher used the Granger causal methodology during the time period 1970-2014 by determining the direction of causation between fluctuations in real oil prices and the most important main variables of financial policy in Algeria (government spending, operating and equipment costs). The results revealed that there is a causal relationship that tends from oil prices towards the indicators of the general budget in the country. Ben Dhman's results recommended a strong need to diversify the economy for the sake of reducing the impact of oil price fluctuations on government revenues.

(Mestfai & bekhti, 2017)The significance of this research stems from the need to figure out the impact of oil price fluctuations on public expenditures during the period 1986-2016. The ECM error correction model was employed to test the hypotheses set out in the study. It was found that oil prices directly affect public expenditures as they contribute to petroleum taxation, whereby the higher the price by 1% leads to expenditures increased by 0.856 percent.

(Mansouri, 2020): The study aims to identify and analyze the asymmetric impact of oil prices on the government's spending in Algeria during the period (1980-2018). The researcher used the Nonlinear Autoregressive Distributed Lag (NARDL). The results revealed that there is a short-run and long-run correlation between oil prices and government expenditure, where higher oil prices lead to increased expenditure; this demonstrates the government's pursuit of an expansionist policy. On the other hand, lower oil prices lead to higher expenditure but less compared to the increase. This is the result of the Government's policy of rationalizing public expenditures.

2-The Theoretical Framework of the Study

2-1 Oil Crises during the Study Period

2-1-1 The Oil Crisis of 1986

By the end of 1985, oil prices had been stable at historically high levels of 30$ a barrel for three years. However, the increased production among non-OPEC producers led to a sudden collapse in oil prices. In this respect, the Soviet Union quickly became the largest oil producer in the world in 1982; thus, the global supply of oil began to increase sharply. Actually, the world was in trouble when oil prices collapsed by 60% in 1986. At that time, Saudi Arabia responded by reducing the oil to 3.8 million barrels per day; however, oil prices did not respond and nothing changed. Moreover, all other OPEC members raised their production to compensate for the loss of revenue caused by the fall in prices (Griffan & Gately, 1989, pp. 237-284)

2-1-2 The Oil Crisis of 1998

The large imbalance in demand and supply led to the deterioration of oil prices to below 10 $ per barrel for the following reasons:

- The accumulation of oil stocks to high levels especially by the members of OPEC due to the economic problems that they were suffering from. In this regard, Iraq launched a project in 1998 to increase oil production in order to secure its food needs (Mabro, 1998, p. 47)
- The decline in the economic growth rate in Japan and the economic crisis in East Asia resulted in a shortfall in demand due to a shortage of energy consumption especially oil (Hamilton, 2011, pp. 19-20).

2-1-3 The Oil Crisis of 2004

Interestingly, the year 2004 witnessed a noticeable rise in oil prices reaching 36 dollars per barrel. It continued to rise gradually reaching from 42 dollars in the second quarter to 50 dollars in the last quarter of 2004. Such radical change was due to the following reasons:

- The high rate of global growth resulted in the increase in global demand for oil in the United States, China and East Asian countries (Mouri, 2015, p. 20)
- The political crises in Iraq, Venezuela and Nigeria forced a 10% reduction in the production.
- Suspension of production in the Russian company Yukos due to its exposure to problems as a result of the volume of taxes imposed on it which led to an increase in the price ratio, which reached 23% (Moussaoui, 2005, pp. 02-20).

2-1-4 The Oil Crisis of 2009

After the rise in the price of oil in mid-2008 which reached 113 dollars per barrel, it witnessed a noticeable decline in the late months, as the price reached below 52.5 million dollars. Undoubtedly, the first reason is the real estate mortgage crisis in 2008 after the continuous collapses in the financial markets and banking institutions until the month of May, the price has gone back up for the following reasons:

- Reduction made by OPEC in the early of January 2009, reducing 4 million barrels per day and this helped in reducing the market surplus (Mihoub, 2012, p. 113).
- Nigeria's political turmoil coincided with the continuation of the conflict in Iraq.
- Negative effects of natural disasters in Mexico on oil companies resulting in higher prices (Lutz, Rebucci, & Spata, Oil Shocks and External Balances, 2009, pp. 181-194).

2-1-5 The Oil Crisis of 2014

During the first half of 2014, oil import prices rose by 10.7% in comparison to the end of 2013. However, in the second half of 2014, things began to change. From the beginning of July, prices began to deteriorate, with the crude oil import index falling 51.7% between July 2014 and January 2015 (Belbachir & Brahami, 2022, p. 233). This decline was due to the fact that many energy companies agree that it is profitable to start extracting oil from hard places in the United States. Consequently, companies began using new technologies to extract oil from rock formations in North Dakota and Texas which led to a boom in oil production 'Unconventional'. In this respect, the United States has alone added an additional of 4 million barrels of crude oil per day to the global market since 2008 ،2015(Dave &

Porscha , 2015, p. 04) More importantly, the demand for oil in Asia and Europe suddenly began to weaken due to the decline of oil demand in China and Germany. On the other hand, demand for oil has been steady in many places around the world, and the United States, the world's largest oil consumer, has seen a stagnation in gasoline consumption, while countries such as Indonesia and Iran have cut subsidies for fuel users .(Lutz & Daniel , The Role of Inventories and Speculative Trading in the Global Market for Crude Oil, 2014, pp. 471-473)

2-2 The Growing Importance of Geopolitics in the Energy Sector

The global energy sector especially the oil market has always been subject to geopolitical pulses since the oil crisis of the 1970s. In fact, geopolitics has been an important factor in determining the global oil price and the need for energy security has driven many relationships on the international scale.

However, it is true to say that geopolitics has gained considerable significance over the past few years. Political relations between some of the main producers of oil and gas producers (Saudi Arabia, Venezuela, Russia, Iran), with one of the major producers (US) as well as key markets (US, China, EU) is full of tension and uncertainty as well as complexities. In this respect, it can be said that some old alliances such as the relationship between the US and Saudi Arabia have been shaken by political developments (Bridge, 2015, pp. 328–339).

Moreover, it is important to enhance understanding of technological, environmental and economic factors of global production patterns and demand. Also, it is significant to understand how geopolitics affects global energy markets (Escribano & Valdés, 2016, p. 701).

2-3 The Concept of Public Expenditures

2-3-1 The Definition of Public Expenditures

Public expenditures is defined as a sum of money (economic or monetary) issued by the State or for any public moral person, with a view to achieving public benefit (Hamoud ELkaissi, 2011, p. 36) The maintenance is also defined as "a sum of money spent by a public person in order to satisfy public needs (Khoubaba, 2009, p. 9)Through these definitions, it can be concluded that the concept of public expenditures is a monetary sum issued by the State or by any member of the law in order to achieve public benefits.

2-3-2 Reasons for Increased Public Expenditure

In his study on developments in public expenditures in European countries, Wagner (1982) concluded that, in the event of a high rate of growth, the expansion of the State’s activity would further increase its public expenditures more than a per capita rate of national output in order to achieve political and economic stability. Keynes also explained that the state should increase public expenditures in the event of recession through the establishment of generalized projects to operationalize the economic activities (Shahada Al Khatib & Chamya, 2007, p. 125).

Drawing on the previous researches on public expenditures, it can be said that economic growth is considered as one of the main objectives that societies seek to achieve. As a matter of fact, there is a great need to increase government spending by increasing national income so that projects can be implemented by spending money on productive sectors and improving them by infrastructure, technical and scientific skills in addition to modern technological methods (Ben Moussa & Nabawia, 2014, p. 180);

2-3-3 Rationalization of Public Expenditures

A common notion is that the rationalization of public expenditures means only reducing them, but when considering the State's reliance on policy instruments for the achievement of society's goals of redistributing equitable incomes, development and economic stability, the concept becomes not comprehensive. As a matter of fact, rationalization of expenditures means working towards optimal allocation and reorientation of resources in order to achieve social justice and economic well-being and thus economic and political security and stability as well (Mejlakh & Bechichi, 2018, p. 74).

3-Econometric Study

After presenting the review of the literature and the theoretical framework of the study variables, the limits of the study, the adopted statistical methods and the sources of the variables should be also defined.

3-1 Variables of the Study

The following variables were used that reflects the study:

Public expenditure dp (dependent variable)

Oil price (independent variable)

3-2 Study Limits

The study was conducted in Algeria during the period (1986-2020) in Algeria

3-3 The Sources of the Study

The data of the study were obtained from the websites of the Central Bank and Knoema.

3-4 Statistical Methods

To reach the objectives of the current study, economic measurement models have been applied to determine the impact of oil price fluctuations on public expenditures.

3-4-1 Stationarity Test Study Variables

The Unit Root Test is conducted by Philips Perron (PP), one of the best tests to avoid false regression and relies on two hypotheses where:

- Null hypothesis H0: The series contains the roots of the unit so that it is non-stationary and cannot be used in estimation.
- Alternative hypothesis H1: The series does not contain the roots of the unit from which the series is stationary and can be used in estimation.

The table shows the results of the following tests:

Table (1): The Results of Unit Root Test (PP Test)

VARIABLE	Unit Root Test (PP Test)		value calculated	P VALUE
OIL	**At level**	with a constant and a trend	1.854711	0.0721
		with a constant	1.240815	0.2227
		no constant	-0.410654	0.5288
	After first difference	with a constant and a trend	0.420650	0.6767
		with a constant	0.404977	0.6880
		no constant	-5.226828	0.0000
DP	**At level**	with a constant and a	1.533893	0.1340

		trend		
		with a constant	1.073655	0.2901
		no constant	0.580819	0.8374
	After first difference	with a constant and a trend	0.573363	0.5702
		with a constant	1.091574	0.2825
		no constant	-4.474724	0.0000

Source: Prepared by the Researcher (Eviews 12)

By observing the table, we find that the series are not stationary at the level of the unit roots (the tab value is higher than the value calculated at 5%); however, the series becomes stationary after making the first differences without constant and trend. Consequently, we accept the alternative hypothesis that the series does not contain the unit roots which means that the series is stationary and can be used in estimation; therefore, the series are stationary and integrated of degree one I(1).

3-4-2 Angel-granger Approach for Testing Cointegration Relationship

After having the stationarity of the series in the first difference, this leads us to the possibility of a cointegration between the two variables, i.e, the existence of a long-run equilibrium relationship. To conduct this test, the following phases should be done:

Phase1: The estimation of the long-run relationship between the variables (oil) and (dp) in OLS micro-squares. Thus, we got the following results:

Table (2): A Long-run Relationship Estimation

Dependent Variable: DP
Method: Least Squares
Date: 06/29/22 Time: 20:05
Sample: 1986 2020
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OIL	3.35E+08	36989012	9.061262	0.0000
C	3.70E+09	1.97E+09	1.878452	0.0692

R-squared	0.713309	Mean dependent var	1.83E+10
Adjusted R-squared	0.704621	S.D. dependent var	1.23E+10
S.E. of regression	6.67E+09	Akaike info criterion	48.13396
Sum squared resid	1.47E+21	Schwarz criterion	48.22284
Log likelihood	-840.3443	Hannan-Quinn criter.	48.16464
F-statistic	82.10648	Durbin-Watson stat	0.326199
Prob(F-statistic)	0.000000		

Source: Prepared by the Researcher (Eviews 12)

Data Analysis

- The constant is not significant. The P value is equal to 0.0692. Thus, we accept the null hypothesis that the constant is equal to zero.

- Oil price coefficient is significant because the probability is below the significant level of 5%.
- A correlation between oil prices and public expenditures with a value of 0.71.

The Estimation of the Relationship without Constant (None)

Table (3): Relationship Rating without Constant

Dependent Variable: DP
Method: Least Squares
Date: 06/29/22 Time: 20:09
Sample: 1986 2020
Included observations: 35

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OIL	3.92E+08	21943012	17.87102	0.0000

R-squared	0.682654	Mean dependent var	1.83E+10
Adjusted R-squared	0.682654	S.D. dependent var	1.23E+10
S.E. of regression	6.91E+09	Akaike info criterion	48.17841
Sum squared resid	1.62E+21	Schwarz criterion	48.22285
Log likelihood	-842.1221	Hannan-Quinn criter.	48.19375
Durbin-Watson stat	0.403581		

Source: Prepared by the Researcher (Eviews 12)

Phase 2: Stationarity Test Residuals Series by Augmented Dickey-Fuller Test as it was recommended by Angel Granger.

Table (4): Test Results of the residuals Series

Variable	**Unit Root Test ADF**		**P Value**	**Value calculated**
the residuals Series	**At level**	with a constant and a trend	0.1936	0.7049
		with a constant	0.6489	0.4410
		no constant	2.4116	0.0171

Source: Prepared by the Researcher (Eviews 12)

From the above table, we note in the unit root test without constant and trend, the probability value is less than 5% (calculated value is higher than the tab value) from which we accept the alternative hypothesis that the series does not contain unit roots and thus the series is stationary at level.

Since the residuals series is stationary at the level, we can say that there is a long-run cointegration between oil prices and public expenditures in Algeria

Estimating error correction model ECM

As a matter of fact, we have found a long-run relationship between oil prices and public expenditures; thus, this leads us to look at the short-run relationship using the error correction model ECM through the following steps:

Step 1: the Estimation of the relationship after making differences with the insertion of the slow residual series in one time period based on the OLS micro-square method where we got the following results:

Table (5): Estimation of Short-run Relationship in the OLS Method

Dependent Variable: DDP
Method: Least Squares
Date: 06/29/22 Time: 20:38
Sample (adjusted): 1987 2020
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOIL	20874659	8939793.	2.335027	0.0260
ET(-1)	-0.194129	0.073687	-2.634523	0.0129

R-squared	0.272105	Mean dependent var	5.02E+08
Adjusted R-squared	0.249358	S.D. dependent var	3.24E+09
S.E. of regression	2.81E+09	Akaike info criterion	46.40700
Sum squared resid	2.52E+20	Schwarz criterion	46.49678
Log likelihood	-786.9190	Hannan-Quinn criter.	46.43762
Durbin-Watson stat	1.907344		

Source: Prepared by the Researcher (Eviews 12)

Analysis of results obtained

Adjustment towards equilibrium -0.194129 is negative and significant than 5%; therefore, there is a short-run balance between oil prices and public expenditures.

- The value -0.194129 indicates that public expenditures return to its equiponderant value in each period with 19%. Additionally, it corrects the imbalance between the short and long-run
- The probability value of the oil price factor is less than 5% and this indicates the existence of the error correction model.

Step 2: Residual diagnostic plots where we will carry out a set of tests related to the statistical problems for econometric study.

This is to confirm or disconfirm the model.

Problem of serial correlation (LM Test): This test is one of the most important tests where it is used to detect if autocorrelation exists or not in the residual series. We will illustrate them in the following table:

Table (6): Problem of serial correlation (LM Test)

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	69.12578	Prob. F(1,32)	0.1971
Obs*R-squared	23.92468	Prob. Chi-Square(1)	0.1685

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/29/22 Time: 21:42
Sample: 1986 2020
Included observations: 35
Presample missing value lagged residuals set to zero.

Source: Prepared by the Researcher (Eviews 12)

From the above table, it can be clearly observed that the p-value is not significant higher than 5%. Thus, we accept the null hypothesis that autocorrelation does not exist in residual series.

Problem of heteroscedasticity (White Test): This test is used to detect the homogeneity of the variance whether it happened or not. The following table explains this idea:

Table (7): Heteroskedasticity Test (White Test)

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	7.561836	Prob. F(2,32)	0.4044
Obs*R-squared	11.23275	Prob. Chi-Square(2)	0.3634
Scaled explained SS	13.09465	Prob. Chi-Square(2)	0.0014

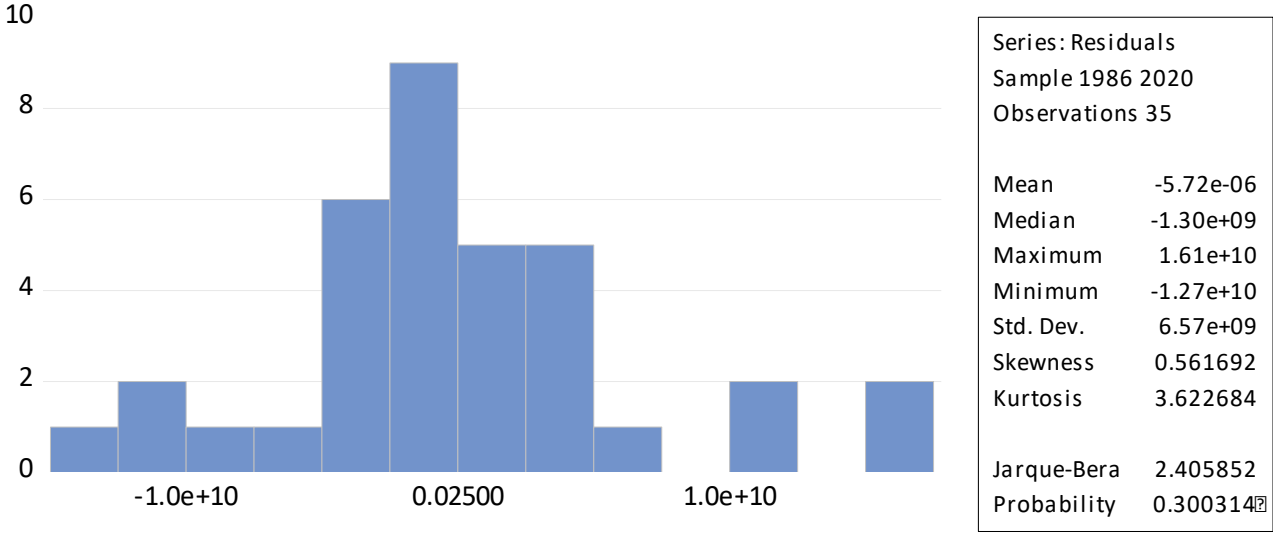
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 06/29/22 Time: 21:47
Sample: 1986 2020
Included observations: 35

Source: Prepared by the Researcher (Eviews 12)

It can be noted from the table that the p-value is higher than 5%; consequently, we accept the null hypothesis that there is homogeneity in the residual series (homogeneity of variance).

Normality test jarque-bera: This test is employed to detect the residual series if it follows the normal distribution or not. The following table shows the test result:

Table (8): Normality Test Jarque-Bera



Source: Prepared by the Researcher (Eviews 12)

Through the results obtained, we come to the fact that the estimated model does not contain statistical problems either in terms of correlation problem nor in terms of heterogeneity, and it also follows the normal distribution. This means confirming the integrity of the error correction model (ECM). Additionally, there is a cointegration long-run and a short-run between public expenditures and oil prices.

4- Econometric Analysis of the Study

Through our econometric study, we concluded that there is a long-run correlation between oil prices and public expenditures by 70% and the rest is explained by other factors that are not included in the current model. Actually, the higher the price of oil by one unit, the higher the public expenditures by 3.97 and the same in the case of oil price collapse; this applies with the economic rent. In addition, there is a positive relationship in the short-run and therefore the reduction of oil prices has a negative effect on the national economy. This is what we have

recently observed in the Government's austerity policies and the rationalization of expenditures.

Conclusion:

Algeria suffers from the problem of oil price fluctuations, which calls for the search for other sources of income such as investment in the industrial, agricultural and tourist sectors in order to eliminate the absolute dependence of the fuel sector. Additionally, the promotion of renewable energy investment projects such as wind, solar and nuclear energy are also among the best solutions as they do not run out. We also highlight the need to rationalize expenditures on the part of investment expenditures. Furthermore, we recommend to move away from big and costly projects with low economic returns and spending money on infrastructure projects with a significant economic supply to maintain economic and political stability and therefore improving people's living conditions.

Some Suggested Recommendations

- The need a strict policy that supports economic diversification by stimulating productive sectors such as industry, agriculture and services.
- Investment in the human component and human resources development in all sectors, depending on the quality of education outputs, training, capacity-building and skills acquisition, to ensure the effective and efficient functioning of public affairs.
- Pursuing a well-defined promotional policy to highlight investment opportunities in Algeria by introducing a stimulus tax policy and stabilizing laws and legislation governing economic activity.
- Activating the function of supervisory bodies and confront administrational and financial corruption, and enhance transparency.

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