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The impact of oil prices fluctuations on public expenditures in Algeria during 1989-2019

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Abstract

This study aims to test the impact of oil prices on public expenditures in Algeria during the period 1989-2019. In order to achieve this goal, the study relied on the ARDL method for the processing of statistical data, where the model includes public expenditures as a dependent variable and oil prices as an independent variable.

The study concluded that there is no co-integration between the variables, therefore, the presence of a relationship that is integrative and equilibrium in the long term between public spending and oil prices.

- ✓ **Keyword**: Government expenditures, economic growth, national income, oil prices, oil demand.

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1. INTRODUCTION

Oil occupies an important place within the economic and political geography of the world, due to its many advantages and vitality not available in other energy sources, which have made it an irreplaceable strategic resource in contemporary time, oil is exchanged through a global market characterized by intense competition and conflict of economic interests between the producing countries and its exporter, which seeks to stabilize its price at the level of their development aspirations, and industrialized countries that consume oil in their various activities where It seeks to obtain the most abundant quantities of it at low prices, which is what made oil prices vulnerable to constant fluctuations.

Algeria is replete with a significant stock of oil, which made it occupy an important position among the group of oil-exporting countries, and this is what made it dependent on this resource as a major source of foreign currency, where oil dominates the structure of the total exports of the state, especially since the beginning of the third millennium, in which the proportion of oil in total exports ranged between 95.25% and 98.40%, and in light of the weakness recorded in other non-oil sectors, Algeria has remained dependent on these revenues primarily in drawing Its development plans, where it contributed significantly to the development of the performance of the national economy through the stability and balance of the public budget in Algeria, which is first dependent on the oil collection, and the latter is the official financier of revenues for the public budget, this has made the levels of public spending also affected by the volume of public revenues negatively and positively depending on the fluctuations of petroleum collection.

1.1. Study problem:

In light of the previous situation, the effectiveness and stability of fiscal policy in Algeria depends primarily on the fluctuations in oil prices, where fiscal policy in the national economy through the policy of public spending specifically played the prominent role in drawing the basic parameters of the national economy during the period 1989-2019 in which the price of oil was the main guide for several very important economic decisions, as Algeria achieved huge financial revenues due to the fact that the price of oil was the main guide for several very important economic decisions, The rise in the index in oil prices led to the adoption of an expansionary policy through the renewal of economic recovery programs, an increase that was difficult to cancel when the sudden collapse of oil prices occurred in 2014 and it appeared that the boom in oil prices was only a temporary case, which ultimately called for an austerity policy of reducing the volume of public expenditures to address the situation, hence the problem of this study as follows:

What is the effect of oil prices fluctuations on public expenditures in Algeria during 1989-2019?

This problem can be divided into the following two questions:

a) is There a long-run equilibrium relationship between oil prices and public expenditures in Algeria during the period 1989-2019?
b) Is there a statistical significance between oil prices and public expenditures in Algeria during the period 1989-2019?
c) How do oil prices affect public expenditures in Algeria during the period 1989-2019?

1.2. Study hypotheses:

a) There is a long-run equilibrium relationship between oil prices and public expenditures in Algeria during the period 1989-2019;
b) There is a statistical significance between oil prices and public expenditures in Algeria during the period 1989-2019;
c) Oil prices affect public expenditures in Algeria during the period 1989-2019.

1.3. study objectives:

The objectives of this study are:

- Highlighting the impact of oil prices fluctuations on the public expenditures in Algeria between 1989-2019.
- Provide recommendations that aim to reduce the negative effects of fluctuations in oil prices in Algeria and to benefit from times of oil market recovery.

1.4. study methods and tools:

To analyse this relationship, and achieve these goals, we use a quantitative (experimental) approach based on the ARDL model using two variables: Public expenditures as a dependent variable and oil prices as an independent variable. we will use Eviews12 programs.

1.5. Study Structure:

this paper consists of 7 main sections including the introduction. Section 2 discuss The Effect of Oil Price Fluctuations on Government

Spending in Empirical Literature. Section 3 The impact of oil price fluctuations on the exporting countries and its transmission channels. Section 4 results and discussion of The effect of Oil Price Fluctuations on Public Expenditures in Algeria. Section 5 conclusion. Section 6 Recommendations.

2. The Effect of Oil Price Fluctuations on Government Spending in Empirical Literature

Given the vital role of oil in the world economy and the volatility associated with its prices, especially in oil dependent countries. A lot of research unveiled the various effects of the volatility of oil price on public expenditures, listed from oldest to newest;

- (Belabes Azzeddine Bessissa, 2020)This study was about how much the changes in oil prices influence public expenditures in Algeria from 1990 to 2017, Appling the VAR model on annual data for oil prices and Government expenditures time series, and revealed the existence of direct short-term relationship between the two variables mentioned above.
- (Raouf, 2021) this study discuss how oil price shocks affect government spending on the countries that export and import oil between 1980 and 2018, and among the tools used in order to achieve this goal: vector autoregressive model. The study concluded that government expenditure was positively influenced by oil price shocks for exporters and importers.

- (MAIDI Mohamed Elamine, 2022) studied the impact of oil prices fluctuation on public expenditures in Algeria using annual data over the period between 1986 and 2020, using the Angel-granger Approach.

The research unveiled a positive relationship between oil prices and public spending.

- In same vain (Alaeddine raki, 2022)using the ARDL self-regression model from 1983 to 2020 to examines the impact of oil price fluctuations on government spending. used variables oil prices, exchange rate, and Gross domestic product. The study found a long-term significant relationship between variables.

- (Abdelmoumene kouaouci r. b., 2022)the research analysed the impact of oil prices volatility on public expenditures and revenues in Algeria (1995-2020), exploiting Autoregressive Distributed Lag model to reach that goal.

  This study concluded:
  - The oil prices affect exclusively public revenues on short term;

- oil prices affect only public expenditures on long term;

- (Salem Hathroubi, 2022) in this study the researchers examined the relationship between trade balance, government spending and non-oil GDP periodical volatility with oil price cycles in Saudi Arabia (1970-2016).
  In order to answer the question of the study they used partial and multiple wavelet coherence.
  This study found a positive correlation between government spending and oil prices volatility, and a negative correlation between trade balance and oil prices volatility.

3. RESULTS AND DISCUSSION of The Effect of Oil Price Fluctuations on Public Expenditures in Algeria

In this part of the study, we will examine the relationship between oil prices and public spending in Algeria during the period 1989 to 2019 according to the ARDL methodology through the following steps:

3.1- Stability tests of the two time series of public expenditure and oil prices

According to the ARDL methodology as a first stage, the degree of co-integration of both the dependent variable " Public Expenditures(DEP)" and the independent variable "Oil Prices(pp)" is determined, and we will adopt the suitable statistical tests.

3.1.1- stationarity test of the original level of the Public Expenditures time series

According to the methodology described above we estimated the second model of unit root tests.

- ✓ **The Null and Alternative hypothesis are:**

- $\mathbf{H_0}$**:**There is a unit root;
- $\mathbf{H_1}$**:** There is no unit root.

Table 1. model estimation results by the presence of the general and the cutter trend coefficient of the time series of public expenditure

Null Hypothesis: DEP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.763300	0.6971
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEP)
Method: Least Squares
Date: 05/19/22 Time: 00:01
Sample (adjusted): 1990 2019
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEP(-1)	-0.167552	0.095022	-1.763300	0.0892
C	-222910.2	222067.7	-1.003794	0.3244
@TREND("1989")	64998.60	29373.20	2.212854	0.0355

R-squared	0.180884	Mean dependent var	281090.0
Adjusted R-squared	0.120209	S.D. dependent var	477457.0
S.E. of regression	447841.3	Akaike info criterion	28.95690
Sum squared resid	5.42E+12	Schwarz criterion	29.09702
Log likelihood	-431.3536	Hannan-Quinn criter.	29.00173
F-statistic	2.981181	Durbin-Watson stat	2.129929
Prob(F-statistic)	0.067634		

Source: Prepared by the researchers based on EViews.12

From the table it appears that its general trend coefficient is significantly different from zero (0), while it appears through Prob=0.035while at the top of the table we find that the probability value of the root of the unit Prob = 0.6971, and therefore we accept the hypothesis of the existence of the unitary root, which is, the time series is non stationarity at this level.

To examine the stationary of the Public expenditures time series, we perform first-class variances D (DEP).

Table 2. Results of the model estimation with a general trend coefficient and the cutter of the first degree difference series D (DEP)

Null Hypothesis: D(DEP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.973571	0.0002
Test critical values:	1% level	-4.323979	
	5% level	-3.580622	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DEP,2)
Method: Least Squares
Date: 05/19/22 Time: 00:03
Sample (adjusted): 1992 2019
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DEP(-1))	-1.656127	0.277242	-5.973571	0.0000
D(DEP(-1),2)	0.456499	0.183846	2.483053	0.0204
C	63310.66	190875.9	0.331685	0.7430
@TREND("1989")	24578.39	11014.95	2.231366	0.0353

R-squared	0.653142	Mean dependent var	26975.32
Adjusted R-squared	0.609785	S.D. dependent var	709514.2
S.E. of regression	443213.6	Akaike info criterion	28.97305
Sum squared resid	4.71E+12	Schwarz criterion	29.16337
Log likelihood	-401.6228	Hannan-Quinn criter.	29.03124
F-statistic	15.06421	Durbin-Watson stat	1.785494
Prob(F-statistic)	0.000010		

Source: Prepared by the researchers based on EViews.12

We have through the table that the coefficient of the general trend varies significantly on zero(0)Prob = 0.03 and therefore the stability of the first-order differences of the model can be tested where we find that the probability value at the top of the table is equal to 0,002 Prob = which is less than 0,05, and therefore we reject the hypothesis of unit root and accept the stability of the first-order series of (DEP) It is therefore a first-class integrated dependent variable which is one of the prerequisites for the application of ARDL models.

3.1.2- PP time series stability test

Once again we will use the methodology of unit root testing in estimating the three formulas mentioned earlier for oil prices time series.

a) **oil prices time series Stability test at the first difference**

Table 3. Estimation of the model with the presence of the general and the cutter trend coefficient of the time series of oil price

Null Hypothesis: PP has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.039564	0.5569
Test critical values:	1% level		-4.296729	
	5% level		-3.568379	
	10% level		-3.218382	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(PP)				
Method: Least Squares				
Date: 05/19/22 Time: 00:10				
Sample (adjusted): 1990 2019				
Included observations: 30 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP(-1)	-0.281332	0.137937	-2.039564	0.0513
C	3.604756	5.471460	0.658829	0.5156
@TREND("1989")	0.688260	0.481655	1.428950	0.1645
R-squared	0.134888	Meandependent var		1.566333
Adjusted R-squared	0.070805	S.D. dependent var		15.09970
S.E. of regression	14.55531	Akaike info criterion		8.288429
Sumsquaredresid	5720.143	Schwarz criterion		8.428548
Log likelihood	-121.3264	Hannan-Quinn criter.		8.333254
F-statistic	2.104912	Durbin-Watson stat		1.767172
Prob(F-statistic)	0.141409			

Source: performed by the authors using EViews.12

We note from the table above that the coefficient of the general trend is not significantly different from zero (0), and therefore in order to test stability we pass to the second model with the presence of the cutter.

Table 4. Estimating the model by the presence of the cutter of the time series of oil prices

Null Hypothesis: PP has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.445736	0.5467
Test critical values:	1% level		-3.670170	
	5% level		-2.963972	
	10% level		-2.621007	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(PP)				
Method: Least Squares				
Date: 05/19/22 Time: 00:11				
Sample (adjusted): 1990 2019				
Included observations: 30 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP(-1)	-0.129461	0.089547	-1.445736	0.1594
C	7.413501	4.866420	1.523399	0.1389
R-squared	0.069463	Meandependent var		1.566333
Adjusted R-squared	0.036230	S.D. dependent var		15.09970
S.E. of regression	14.82365	Akaike info criterion		8.294665
Sumsquaredresid	6152.733	Schwarz criterion		8.388078
Log likelihood	-122.4200	Hannan-Quinn criter.		8.324548
F-statistic	2.090152	Durbin-Watson stat		1.902811
Prob(F-statistic)	0.159352			

Source: Prepared by the researchers based on EViews.12

From the table it is clear that the constant has no statistical significance (Prob = 0.1389) and therefore a we pass to for the third model of stability test.

Table 5. Estimation of the model without the cutter and without a general trend The time series of oil prices

Null Hypothesis: PP has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.315928	0.5632
Test critical values:	1% level		-2.644302	
	5% level		-1.952473	
	10% level		-1.610211	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(PP)				
Method: Least Squares				
Date: 05/19/22 Time: 00:11				

Sample (adjusted): 1990 2019				
Included observations: 30 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP(-1)	-0.016088	0.050922	-0.315928	0.7543
R-squared	-0.007663	Meandependent var		1.566333
Adjusted R-squared	-0.007663	S.D. dependent var		15.09970
S.E. of regression	15.15744	Akaikeinfocriterion		8.307626
Sumsquaredresid	6662.695	Schwarz criterion		8.354332
Log likelihood	-123.6144	Hannan-Quinn criter.		8.322568
Durbin-Watson stat	1.967241			

Source: Prepared by the researchers based on EViews.12

We have in the table above the probability value Prob = 0.5632 greater than 0.05 and therefore we accept the hypothesis of existence of the unit because the time series of oil prices is unstable at the original level.

In order to ensure stability, first-class differences must be made.

b) **oil prices time series Stability test at first-class differences:**

Table 6. Results of the stability test of the model with the presence of the general and the cutter trend coefficient at the first class differences D(PP) of the time series of oil prices

Null Hypothesis: D(PP) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 2 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.729459	0.0041
Test critical values:	1% level		-4.339330	
	5% level		-3.587527	
	10% level		-3.229230	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(PP,2)				
Method: Least Squares				
Date: 05/19/22 Time: 00:11				
Sample (adjusted): 1993 2019				
Included observations: 27 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PP(-1))	-1.507684	0.318786	-4.729459	0.0001
D(PP(-1),2)	0.520972	0.268983	1.936821	0.0657
D(PP(-2),2)	0.541476	0.188716	2.869270	0.0089
C	6.525512	6.910164	0.944335	0.3553
@TREND("1989")	-0.259106	0.367489	-0.705072	0.4882
R-squared	0.640623	Meandependent var		-0.196296
Adjusted R-squared	0.575282	S.D. dependent var		22.56001

S.E. of regression	14.70244	Akaike info criterion		8.379480
Sumsquaredresid	4755.561	Schwarz criterion		8.619450
Log likelihood	-108.1230	Hannan-Quinn criter.		8.450836
F-statistic	9.804273	Durbin-Watson stat		1.895581
Prob(F-statistic)	0.000104			

Source: Prepared by the researchers based on EViews.12

We have in the table that the coefficient of the general trend does not differ significantly from zero, so in order to test the stability we pass to the next model.

Table 7. time series D(PP) stability test Results in presence of the cutter

Null Hypothesis: D(PP) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.729463	0.0008
Test critical values:	1% level		-3.699871	
	5% level		-2.976263	
	10% level		-2.627420	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(PP,2)				
Method: Least Squares				
Date: 05/19/22 Time: 00:12				
Sample (adjusted): 1993 2019				
Included observations: 27 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PP(-1))	-1.478419	0.312598	-4.729463	0.0001
D(PP(-1),2)	0.493826	0.263287	1.875617	0.0735
D(PP(-2),2)	0.523834	0.184993	2.831636	0.0095
C	2.090755	2.830165	0.738740	0.4675
R-squared	0.632503	Meandependent var		-0.196296
Adjusted R-squared	0.584568	S.D. dependent var		22.56001
S.E. of regression	14.54083	Akaike info criterion		8.327752
Sumsquaredresid	4863.021	Schwarz criterion		8.519727
Log likelihood	-108.4246	Hannan-Quinn criter.		8.384836
F-statistic	13.19515	Durbin-Watson stat		1.863609
Prob(F-statistic)	0.000032			

Source: Prepared by the researchers based on EViews.12

We note from the table above that the cutter is not significantly different from zero and therefore we pass to the next model.

Table 8. Stability test for time series D(PP) without cutter and without general direction of the time series of oil prices

Null Hypothesis: D(PP) has a unit root				
Exogenous: None				
Lag Length: 2 (Automatic - based on SIC, maxlag=7)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.716841	0.0000
Test critical values:	1% level		-2.653401	
	5% level		-1.953858	
	10% level		-1.609571	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(PP,2)				
Method: Least Squares				
Date: 05/19/22 Time: 00:12				
Sample (adjusted): 1993 2019				
Included observations: 27 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PP(-1))	-1.445897	0.306539	-4.716841	0.0001
D(PP(-1),2)	0.476897	0.259794	1.835676	0.0788
D(PP(-2),2)	0.516717	0.182986	2.823815	0.0094
R-squared	0.623783	Meandependent var		-0.196296
Adjusted R-squared	0.592431	S.D. dependent var		22.56001
S.E. of regression	14.40256	Akaike info criterion		8.277128
Sumsquaredresid	4978.409	Schwarz criterion		8.421110
Log likelihood	-108.7412	Hannan-Quinn criter.		8.319941
Durbin-Watson stat	1.852041			

Source: Prepared by the researchers based on EViews.12

The probability value = 0.000 shows that itis less than 0.05 and therefore we reject the hypothesis that there is a unitary root on it, the D(PP) series is stable and therefore we say that the time series of oil prices is integrated from the first degree.

3.2-Estimating the Autoregressive Distributed Lag (ARDL) for Public Expenditures in Algeria and Testing the Relationship of Joint Integration between Oil Prices and Algeria's Public Expenditure

After previous stability tests it was found that the two time series of public expenditures and oil prices we can apply ARDL model to measuring the impact of oil prices on public expenditures, so we try to estimate as much as possible of the formulas and trade-offs between them as follows:

3.2.1-comparaison between ARDL formulas for the relationship studied

The table shows the top 20 estimated formulas for the relationship of Public Expenditure to oil prices using ARDL.

Table 9. shows the best estimated ARDL formulas for the studied relationship

Model Selection Criteria Table						
Dependent Variable: DEP						
Date: 05/19/22 Time: 00:18						
Sample: 1989 2019						
Included observations: 27						
Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
2	-372.652930	28.270587	28.702533	28.399027	0.989121	ARDL(4, 3)
3	-373.714527	28.275150	28.659102	28.389319	0.988850	ARDL(4, 2)
8	-375.132032	28.306076	28.642034	28.405974	0.988235	ARDL(3, 2)
1	-372.322844	28.320211	28.800150	28.462922	0.988759	ARDL(4, 4)
10	-377.475347	28.331507	28.571477	28.402863	0.987277	ARDL(3, 0)
5	-376.883343	28.361729	28.649693	28.447356	0.987243	ARDL(4, 0)
7	-375.126380	28.379732	28.763684	28.493901	0.987621	ARDL(3, 3)
4	-376.449063	28.403634	28.739592	28.503532	0.987029	ARDL(4, 1)
9	-377.471048	28.405263	28.693227	28.490890	0.986676	ARDL(3, 1)
6	-375.086131	28.450825	28.882770	28.579265	0.986972	ARDL(3, 4)
20	-388.944851	29.032952	29.176934	29.075765	0.972725	ARDL(1, 0)
15	-388.212313	29.052764	29.244740	29.109848	0.973042	ARDL(2, 0)
19	-388.885784	29.102651	29.294626	29.159735	0.971663	ARDL(1, 1)
14	-388.211578	29.126784	29.366753	29.198139	0.971818	ARDL(2, 1)
18	-388.814842	29.171470	29.411440	29.242825	0.970531	ARDL(1, 2)
13	-388.194616	29.199601	29.487565	29.285228	0.970514	ARDL(2, 2)
17	-388.764679	29.241828	29.529792	29.327455	0.969242	ARDL(1, 3)
12	-388.133852	29.269174	29.605132	29.369072	0.969178	ARDL(2, 3)
16	-388.666176	29.308606	29.644563	29.408503	0.967939	ARDL(1, 4)
11	-388.030679	29.335606	29.719558	29.449775	0.967803	ARDL(2, 4)

Source: Prepared by the researchers based on EViews.12

The differentiation between the models here was done through the IC, DIC, HQ and LogL preference criteria as well as the corrected selection coefficient. The lower differential criteria we find the better model we get, therefore, we found the best formula ARDL (4; 3) which we will be estimating in the next step.

3.2.2-The results of estimating the best model ARDL representing the relationship of public expenditures expenses to oil prices.

It appears from the previous table that the equation of Autoregressive Distributed Lag for public expenditures in terms of oil prices is written in the following terms:

```
stimation Command:
=========================
ARDL DEP PP @
Estimation Equation:
=========================
DEP = C(1)*DEP(-1) + C(2)*DEP(-2) + C(3)*DEP(-3) + C(4)*DEP(-4) + C(5)*PP + C(6)*PP(-1) + C(7)*PP(-2) + C(8)*PP(-3) + C(9)
Substituted Coefficients:
=========================
DEP = 0.136881080735*DEP(-1) - 0.303580908397*DEP(-2) + 0.54273401596*DEP(-3) + 0.473173586716*DEP(-4) + 19846.2692725*PP + 1181.7792079*PP(-1) + 4433.26337449*PP(-2) + 7068.54554765*PP(-3) - 171353.820847
Cointegrating Equation:
D(DEP) = -0.150792224986*(DEP(-1) - (215726.35728074*PP(-1) - 1136357.13554173))
```

Source: Prepared by the researchers based on EViews.12

Therefore, it appears from this equation that spending is affected by its values of 4 previous years, while spending is affected by the value of the price of oil for the current period and the values of 3 previous years positively, thus, there is a positive relationship between the oil price and public expenditures in an uneven way as follows:

- When oil price augments by one dollar in the current year, spending in the same year increases by 19,846 million centimes.
- In the same way, the previous year's oil price (PP-1) affects a unitary change in spending of 1181 million centimes.
- The price of oil for the previous two years (PP-2) also affects spending with a unitary change of 4433 million centimes.
- The price of oil for the previous 3 years (PP-3) also affects the current spending value of 7068 million centimes.

The total statistical significance of the ARDL equation and the total statistical interpretive strength of the equations are shown by 69%

3.2.3-Testing the relationship of joint integration between oil prices and Algeria's public spending

In this aspect, we will try to test the existence of a long-term equilibrium relationship with the study variables in Algeria before it is necessary to pass the special statistical tests of the ARDL as a condition for the application of joint integration.

First : Residual diagnostic tests.

a) autocorrelation errors test:

To test for the absence of autocorrelation, we use the Breusch-Godfrey test, to achieve this we set the following hypotheses:

- Null hypothesis: the absence of autocorrelation;
- Alternative hypothesis: the existence of autocorrelation.

Table 10. Breusch-Godfrey for autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	2.112736	Prob. F(2,16)	0.1534
Obs*R-squared	5.640794	Prob. Chi-Square(2)	0.0596

Source: Prepared by the researchers based on EViews.12

We have the test probability values for the Lagrange multiplier=0.0596 which is greater than 0.05 and therefore we accept the hypothesis that there is no autocorrelation for errors.

b) Test the hypothesis of the homogeneity of error variance

To reach this goal, we applied the ARCH test to confirm the hypothesis of the constant of the variance of estimated errors (Heteroskedasticity), we put the test hypotheses as follows:

-Null hypothesis: constant variance.

-Alternative hypothesis: non constant variance.

Table 11. ARCH test results

Heteroskedasticity Test: ARCH				
F-statistic	1.003486	Prob. F(1,24)		0.3265
Obs*R-squared	1.043480	Prob. Chi-Square(1)		0.3070
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 05/19/22 Time: 00:25				
Sample (adjusted): 1994 2019				
Included observations: 26 afteradjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.81E+10	1.91E+10	2.521592	0.0187
RESID^2(-1)	0.208157	0.207795	1.001741	0.3265
R-squared	0.040134	Meandependent var		5.90E+10

Adjusted R-squared	0.000139	S.D. dependent var	7.99E+10
S.E. of regression	7.99E+10	Akaike info criterion	53.11913
Sumsquaredresid	1.53E+23	Schwarz criterion	53.21591
Log likelihood	-688.5487	Hannan-Quinn criter.	53.14700
F-statistic	1.003486	Durbin-Watson stat	1.987553
Prob(F-statistic)	0.326462		

Source: Prepared by the researchers based on EViews.12

The probability value of the Lagrange multiplier is equal to (Prob = 0.3070) is greater than 0.05 and therefore we accept the hypothesis of the homogeneity of the variance of estimated errors.

c) Residuals normal distribution Test

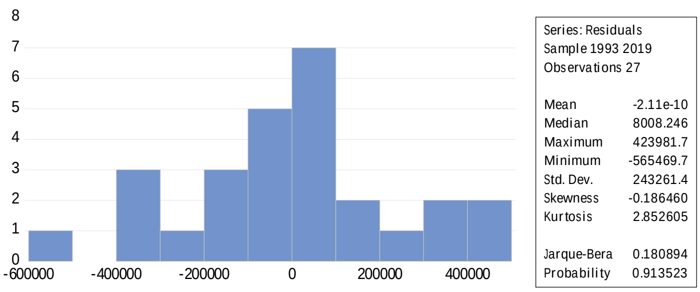
To Calculate the normal distribution of errors we use the Jarque-Bera test where we make the following hypotheses:

-Null hypothesis: errors are normally distributed;

-Alternative hypothesis: Errors are not normally distributed.

The results of this test are illustrated in Figure 2 as follows:

Figure.2. residuals normal distribution



Source: Prepared by the researchers based on EViews.12

We have the probability value of the Jarque-Bera Prob=0.9135 test is greater than 0.05 and therefore we accept the hypothesis of the normal distribution of the residues.

the previous results show the estimated formula of ARDL model that can be used to reveal the relationship of long-term cointegration between oil prices and public expenditures.

Second: F-bounds test for the cointegration of public expenditures and oil prices

To detect a long-term relationship, we use the Bound test, which uses Fisher's statistics and compare them to the proposed critical bounds:

-Lower Critical Bound (LCB): which assumes that the variables are cointegrated from the I(0)degree.

-Upper Critical Border (UCB): which assumes that the variables are cointegrated from the I(1)degree.

The null hypothesis is tested by finding out where Fisher's statistic is located among the three domains.

Table 12. Test of Bounds

ARDL Long Run Form and Bounds Test				
Dependent Variable: D(DEP)				
Selected Model: ARDL(4, 3)				
Case 2: Restricted Constant and No Trend				
Date: 05/19/22 Time: 00:28				
Sample: 1989 2019				
Included observations: 27				
ConditionalError Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-171353.8	122603.9	-1.397622	0.1792
DEP(-1)*	-0.150792	0.054939	-2.744739	0.0133
PP(-1)	32529.86	7579.528	4.291805	0.0004
D(DEP(-1))	-0.712327	0.221526	-3.215549	0.0048
D(DEP(-2))	-1.015908	0.171453	-5.925269	0.0000
D(DEP(-3))	-0.473174	0.248716	-1.902467	0.0732
D(PP)	19846.27	4166.024	4.763840	0.0002
D(PP(-1))	-11501.81	4791.582	-2.400420	0.0274
D(PP(-2))	-7068.546	5824.880	-1.213509	0.2406
* p-value incompatible with t-Bounds distribution.				
Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP	215726.4	42359.01	5.092810	0.0001
C	-1136357.	776751.4	-1.462961	0.1607
EC = DEP - (215726.3573*PP - 1136357.1355)				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	9.615797	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79

		1%	4.94	5.58
ActualSample Size	27		FiniteSample: n=35	
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48
			FiniteSample: n=30	
		10%	3.303	3.797
		5%	4.09	4.663
		1%	6.027	6.76

Source: Prepared by the researchers based on EViews.12

We note from the table above that the calculated value of F- statistic =9.61, while the minimum test that assumes that variables are cointegrated from the original score by taking n=30 and the moral score of 5% is 4.09, and the upper limit that assumes the variables is integrated 4.66, and therefore the calculated value is greater than the upper limit, and therefore we accept the hypothesis of an integrative equilibrium relationship in the long term between expenditures and oil prices.

Third: Estimating the error correction model and the speed of correcting imbalances in the two terms

The ECM error correction model is one of the most effective models to represent the short-term dynamic and long-term equilibrium relationships between the variables of the study, which help us model the adjustments that lead us to the long-term equilibrium state proven by the boundary test.

Table 13. Estimating the Relationship in the Long Term

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP	215726.4	42359.01	5.092810	0.0001
C	-1136357.	776751.4	-1.462961	0.1607
EC = DEP - (215726.3573*PP - 1136357.1355)				

Source: Prepared by the researchers based on EViews.12

It is shown from the table above that the relationship of spending with oil prices devolves towards the relationship described above so that the price of oil affects positively in the case of an increase of $ 1 per barrel, expenditures increase by 215726.4 million and through this relationship can estimate the following error correction model:

Table 14. Estimating the error correction model in the short term

ARDL Error Correction Regression		
Dependent Variable: D(DEP)		
Selected Model: ARDL(4, 3)		
Case 2: Restricted Constant and No Trend		
Date: 05/19/22 Time: 00:33		
Sample: 1989 2019		
Included observations: 27		

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DEP(-1))	-0.712327	0.209868	-3.394160	0.0032
D(DEP(-2))	-1.015908	0.162181	-6.264027	0.0000
D(DEP(-3))	-0.473174	0.232511	-2.035061	0.0568
D(PP)	19846.27	3668.103	5.410499	0.0000
D(PP(-1))	-11501.81	3954.946	-2.908209	0.0094
D(PP(-2))	-7068.546	4680.053	-1.510356	0.1483
CointEq(-1)*	-0.150792	0.026635	-5.661506	0.0000
R-squared	0.762562	Meandependent var		301372.9
Adjusted R-squared	0.691330	S.D. dependent var		499226.7
S.E. of regression	277360.7	Akaike info criterion		28.12244
Sumsquaredresid	1.54E+12	Schwarz criterion		28.45840
Log likelihood	-372.6529	Hannan-Quinn criter.		28.22234
Durbin-Watson stat	2.056975			

Source: Prepared by the researchers based on EViews.12

The table above shows the relationship of oil price and public expenditures in the short-term and the mechanism for correcting imbalances in that term so that the last estimated coefficient in the model shows the error correction coefficient (-0.150792)

That is, when the value of expenditures increases at their equilibrium value determined by the price of oil in the period T-1, the error correction coefficient reduces this deviation by 15% to the level of equilibrium in the following period (T). In order to verify this mechanism, this coefficient must be estimated with a negative sign and have statistical significance, which is achieved through the above results.

4. CONCLUSION

In this study, we examined the extent to which oil price fluctuations affect public spending in Algeria, using a modern statistical method of self-regression of distributed time gaps and their models to answer the problem and verify hypotheses.

- for the **first hypothesis** that was "a long-term equilibrium relationship between public expenditures and oil prices in Algeria (1989-2019)", it has been proven through results of the boundary test of the relationship between oil prices and public expenditures, i.e. we accept the hypothesis;
- for the **second hypothesis**, which was represented in "There is a statistical significance between oil and public expenditure in Algeria (1989-2019)", was proved by the results of estimating the short-term equilibrium relationship since the error correction coefficient is estimated by a negative signal, i.e. it has statistical significance;

- for the **third hypothesis**, which is "Oil prices positively affect public expenditures in Algeria (1989-2019)" have been proven. The correlation coefficient between the two variables is of positive value between oil prices and overheads, so that the higher the oil prices, the greater the general expenditure.

The study concluded with the following conclusions:

- The results of the border test showed a long-term equilibrium relationship between overhead and oil prices;
- Public spending is positively influenced by the value of the current oil price and the values of three previous years;
- Each increase in the price of oil by one dollar per barrel for the current year is offset by an increase in spending of 19,846 million centimes;
- The oil price of the previous year (PP-1) affects a unitary change of spending of 1181 million centimes;
- The price of oil for the previous three years (PP-3) affects current expenditures by 7068 million centimes.

5.Recommendations

Based on the results of this study, we Suggested some Recommendations:

- encourage International Cooperation: Collaborate with international organizations and other oil-dependent countries to exchange best practices, share experiences, and seek support during times of oil price volatility. Engaging in dialogue and cooperation can provide valuable insights and assistance in managing public expenditures in the midst oil price volatility;
- Algeria should focus on diversifying its economy to reduce its dependence on oil. By developing other sectors such as agriculture, manufacturing, tourism, and renewable energy, also can generate additional sources of revenue and mitigate the impact of oil price fluctuations on public expenditures;
- Create a Stabilization Fund: Establishing a stabilization fund can help Algeria save excess oil revenues during periods of Oil market recovery and create a buffer for times of low oil prices. This fund can be used to maintain stable public expenditures during downturns and provide financial stability;
- Prioritize Infrastructure Investments: During periods of high oil prices (Oil market recovery) , Algeria can allocate a portion of its oil revenues to infrastructure development projects. These investments can enhance the country's long-term economic growth, attract foreign investment, and create job opportunities;

- Implement Countercyclical Fiscal Policies: Develop countercyclical fiscal policies that adjust public expenditures in response to oil price fluctuations. During periods of low oil prices, Algeria may need to reduce non-essential expenditures, prioritize critical sectors, and implement austerity measures to maintain fiscal sustainability;
- Enhance Revenue Management: Algeria should focus on improving its revenue management practices, including effective tax collection, reducing tax evasion, and diversifying its revenue base. By broadening its revenue sources, the country can reduce its vulnerability to oil price fluctuations and better manage public expenditures;
- Invest in Human Capital and Social Development: Allocate a portion of oil revenues to invest in education, healthcare, and social development programs. These investments can improve the quality of human capital, promote social welfare, and contribute to long-term sustainable development, irrespective of oil price fluctuations.

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