The asymmetric effect of fiscal policy and oil prices on GDP in Algeria: An NARDL approach 1990-2019

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Received date: 20.09.2020 Accepted date : 04.11.2020/ Publication date:11.12.2020

Abstract:
The aim of this study is to present a brief outlook of fiscal policy concept and to measure and analyze the effect of public policies on economic growth especially during the dual shock of the COVID-19 pandemic and the oil prices plunge. Relying on yearly data (1990-2019), we have estimated a Non-Linear Autoregressive Lag Distributed model (NARDL) to assess the positive and negative effects of the Algerian economic activity during oil prices fluctuation. The findings of our estimation provide that public spending has an insignificant role in Algerian economics, employment rise GDP, and fewer taxes are the best to increase GDP. However, Algeria must adopt new financial instruments to decrease the budget deficit and to solve the oil crisis.

Keywords: government spending, tax revenues, oil prices, NARDL
Jel Classification Codes : C1, E6, H2, H5, O2

Introduction:

The concept of public expenditure evolved with the development of the role of the state in the society and its methods of intervention in economic life. The state had a narrow role (classical theory), where government spending was directed to the traditional functions of the state, such as: defense, security, justice… While this concept moved to the State intervention in the economy (Keynesian theory), which gave public expenditure a significant role in moving the wheel of productivity and achieve the objectives of economic policies such as reducing unemployment rates

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and the provision of jobs ... All this made the subject takes ample space of macroeconomic analysis.

Algeria, like other oil dependent countries, recorded an increase in its oil reserves due to the continuous rise in oil prices since the beginning of the third millennium. Because of the improvement and expansion of the financial situation, expansionary spending policies were pursued through various programs and economic plans in order to raise growth rates. However, this didn't last forever, where the Algerian economy has witnessed many fluctuations such as the oil crisis of 2014, which showed the fragility of the Algerian economy. Thus, the collapse of oil prices had a negative impact on macroeconomic indicators, prompting the state to take urgent solutions. One of these solutions were represented in a series of fiscal policy measures (notably the reduction of public spending, Taxes cuts and reducing imports and varying exports). In light of the above, the problematic of the paper is highlighted as follows: **What are the effects of the government spending policies (expansionary or austerity) on the economic growth in Algeria during the period 1990-2019?**.To achieve this purpose, an alternative econometric framework have been adopted, namely the nonlinear autoregressive distributed lags (NARDL) model recently developed by (Shin, Yu, & Greenwood-Nimmo, 2014) We contend that, in light of the foregoing discussion, the framework is most appropriate since it allows potential long-run and short-run asymmetries in the GDP – Government spending relations.

The study was divided into three sections. The first section highlights the most important previous studies that dealt with this subject. The second section deals with the main concepts of fiscal policy. The third section includes the econometric study of the impact of public expenditure, taxes and oil prices on economic growth in Algeria

1- What is fiscal policy?

(Tanzi, 2006) in his book summarized the origin of the term "fiscal policy", where he mentioned that the origin of "fiscal" is a Latin word *fiscalis* which in turn comes from *fiscus* and means the basket used for collecting money. From another side "fiscal" also means the agency that collects taxes when it refers to the Italian word *il fisco*. Accordingly, 'fiscal policy' means policy related to taxes. In English the expression fiscal policy was apparently first used by Edwin R.A. Seligman, a prominent professor of public finance at Columbia University in the early part of the 20th century.

However, The Keynesian revolution switched the concept of fiscal policy, from the tax or the revenue side of the budget to include both revenue and spending. (Thorndike, 2010).

In the words of (Shaw, 1972) fiscal policy is: *"any decision to change level composition or timing of government expenditure or to vary the burden, the structure or frequency of the tax payment ".*

Another definition set by (Shome, 1997) stating that: *"Fiscal policy is the use of government spending and taxation to influence the economy".*

Fiscal policy is then the measures taken by government using public spending and taxes in order to maintain the balance of government budget and provide social welfare.

2- Fiscal policy tools:

(Taylor, 2000) stressed on the conventional view of fiscal policy that focused on debt sustainability, promoting sustainable growth and reduce poverty by means of predictable fiscal rules for budget deficit and public debt, and priority given to fiscal balance (Parisotto & Ray, 2018)

The role and objectives of fiscal policy have gained prominence in the current crisis as governments have stepped in to support financial systems, jump-start growth, and mitigate the impact of the crisis on vulnerable groups. The fiscal policy tools are presented in the following table:

Table 1. Fiscal policy tools

	Definition	Importance
Taxes	*a compulsory payment to the governments without expectation of direct return to or benefit to the tax payer*	-raising substantial revenues for necessary spending and investment. - promote private savings and investment. - avoid inflation and ensure stability. - provide income and equality and equitable national products
Public spending	*the spending incurred by public authorities to satisfy collective public needs that people in their individual capacity cannot satisfy efficiently*	-contribution to current effective demand; - stabilization, business cycle inversion, and growth purposes; - increase the public endowment of goods for everybody; - increase positive externalities to economy and society as a whole (or in specific sectors and geographical areas), the more so through its capital component.

Source: authors illustration depending on (Kennedy, 2012)

3- Fiscal austerity ::

Austerity also called with other terms: fiscal consolidation, fiscal reform, deficit reduction, fiscal contraction. **(Blyth, 2013)** clarify the meaning of Austerity in his definition *"Austerity is a set of economic policies implemented with the aim of reducing government budget deficits. Policies grouped under the term 'austerity measures' may include spending cuts, tax increases, or a mixture of both, and may be undertaken to demonstrate the government's fiscal discipline to creditors and credit rating agencies by bringing revenues closer to expenditures"*

1.1. the measures of fiscal austerity:

Since the global recession in 2008-2009, different austerity measures have been announced and used, we find two famous targets of austerity following either spending programs or taxes programs.

Table 2. austerity measures

Decrease spending (rationing)	Increase taxing
• Reduce salaries of government employees, benefits, and hours. • Stop spending on new public projects. • Reduce expenses on job contracts. • Canceling vacancies and reallocation of jobs and employees among different government agencies. • Stop buying cars and equipment and reduce the item of operating expenses. • Reducing or cancelling some types of internal and external subsidies and	• Raising taxes on income. • Raising value added taxes. • Targeting tax fraud and tax evasion. • Raise property taxes.

assistance. • Cut programs for the poor. • Extending the eligibility age of retirement and health care benefit	

Source: authors illustration depending on (Blyth, 2013).

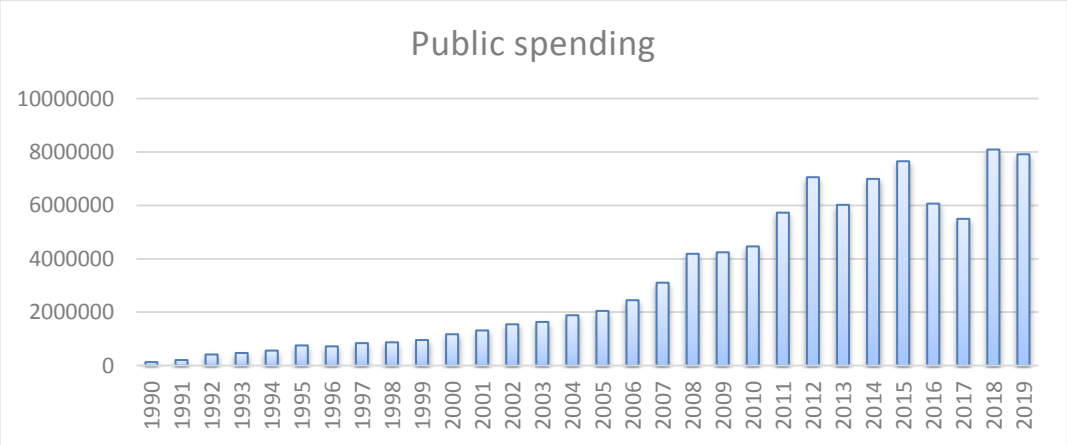
4- Fiscal policy in Algeria:

The development of fiscal policy in Algeria is only the result of the evolution of the role of the state. Where, the fiscal authorities were neutral but due to the economic developments and events, the fiscal policy was forced to abandon the concept of neutrality and intervene in the economy. Considering that the Algerian economy is an oil dependent economy and in light of the diversification`s lack of the government revenues, Algerian authorities must work to rationalize public expenditure in order to ensure the economic efficiency of public revenues. speaking about fiscal policy there are three main tools that we must discuss which are Government spending, Government revenues and government budget. The main development of these elements is summarized as follow:

5.1. The growth of government spending in Algeria:

Through figure 01, a steady increase in the volume of public expenditure in Algeria can be noticed until 2014. This is called expansionary spending policy where this increase is caused by the economic, social and political facts that Algeria have witnessed during the period of the study.

Figure 01. the development of public spending



Source: authors illustration

The growth of public expenditure in Algeria can be divided into three stages which are:

Phase I: the period between 1990 and 1998

The most important feature of this period was the conclusion of cooperation agreements with the international financial institutions in order to adopt the policy of economic openness. However, as noted in the graph, the amount of public spending is gradually increasing, indicating that the agreements concluded were not an obstacle. This was due to the improvement in public revenues due to the

high prices of oil. During this period, Algeria also adopted programs to support disadvantaged groups and several economic reforms.

Phase II: the stage of development programs 1999-2014

From the curve we notice that this stage was characterized by a significant and continuous increase in public spending due to the allocation of a huge budget for a various development programs, and the repayment of foreign debts. This notable growth was due to the high oil prices, which recorded a quantum leap at that time, culminating in the beginning of 2008.

Therefore, the most important characteristic of this period is the Algerian governments of expansionary policy, which is reflected in the following:

Table3.sustainable development programs in Algeria from 1999 to 2014.

Development programs	Year	Spending budget amount	The goal
Economic Recovery Support Program (Triple Plan).	2000-2004	16 billions dollars	stimulating national institutions and market demand
Supplementary Program for Growth Support.	2005-2009	130 billion dollars	Expanding infrastructures
Growth Consolidation Program.	2010-2014	286 billion dollars	Diversification of the Algerian economy and stimulation of the national production machinery

Source: authors illustration

Phase III: 2014-2019

The most important characteristic of this stage is the collapse of oil prices after the middle of 2014, which revealed the fragility of the national economy. Due to the dependence of Algeria's public revenues on oil revenues, its decline was followed by a decrease in expenditure in 2014. However, in 2015 we notice a slight increase due to the "plan to support the new growth (2015-2019)".

This development program was followed by a decline in public spending from 2016 and 2017 where the Algerian authorities adopted policy of austerity, which has burden on citizens by imposing new taxes, raising fuel and electricity prices and the car voucher in order to create additional resources for the state budget and compensate for the decline in state revenues due to the collapse of fuel prices. In addition, the fiscal amendment has led to the raising of the car voucher and the value added of the dinar as well as the consumption of natural gas and electricity, which exceeds a certain limit. Algeria remains economically independent due to the accumulation of exchange reserves during the past years, but these reserves have known a continuous depletion to fall from 193 billion dollars a month May 2014 to $ 105 billion in July 2017**(IMF Country Report 2017).**. However, **(Chibi, Benbouziane, & Chekouri, 2019)**have stated that *"the 2018' budget included an important increase in spending, which will result in a deficit more than 6% of GDP higher than originally planned under the 2017–2019 MTBF. Capital expenditures would increase by 21.2% in nominal terms from 2017, including repaying arrears, and current expenditures by 6.9%, including a significant transfer to the National Social Insurance Fund. The wage bill is kept virtually flat in nominal terms. The government intends to resume consolidation in 2019, with sharp cuts in spending*

5.2. Taxes revenues:

One of the sources of government revenue is tax. From Figure 2, we can notice that the government revenues are doubling but then again decreasing especially in 1998, 2008, and 2014 that represent the financial oil crisis in Algeria. Otherwise, the Algerian government depend on the revenues of taxes especially the collection of petroleum, which is an irregular tax. but after the 2014's crisis, Algeria adopted austerity policy to cover the deficit by looking for other revenue sources as raising some regular taxes such as TVA (from 17% to 21%) this is why even the crisis but the revenues still go up. Additionally, Algeria's 2019 Finance Bill (the Act) came into force as of 1 January 2019. Despite no increase in tax rates, the Act introduced, as well as amended, several measures targeting increased fiscal revenues through expanded tax bases and tighter control mechanisms.

Figure 02. the development of public spending

Source: authors illustration

5- Methods and materials

This study uses five macroeconomic variables based on annual data from 1990 to 2019, which were extracted from World Bank indicators, International Monetary Fund database and from Algerian central bank and Algerian fiscal sheets.

The general form of our study is illustrated in the following equation:

$$GDP = \int(EXPN, Taxes, Op, Um)$$

$$GDP = \beta_0 + \beta_1 EXPN + \beta_2 TAX + \beta_3 Op + \beta_4 UMe_t \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

GDP is the Gross Domestic Product (in % represent the economic growth)
EXPN refers to Government Expenditures.
Taxes points to taxes revenues.
Op is crude oil prices
Um is Unemployment.

As shown in (Shin et al., 2014) equation (1) can be framed in an ARDL setting along the line with (Pesaran, Shin, & Smith, 1999) and (Pesaran, Shin, & Smith, 2001) as:

$$\Delta GDP_t = \alpha + \beta_0 GDP_{t-1} + \beta_1 Op^{+}_{t-1} + \beta_2 Op^{-}_{t-1} + \beta_3 EXPN^{+}_{t-1} + \beta_4 EXPN^{-}_{t-1} + \beta_5 Taxes^{+}_{t-1} + \beta_6 Taxes^{-}_{t-1} + \beta_0 Um_{t-1} + \sum_{i=1}^{P} \gamma i \Delta GDP_{it-i} + \sum_{i=1}^{q} (\delta_i{}^{+} \Delta Op^{+}_{t-i} + \delta_i^{-} \Delta Op^{-}_{t-i}) + \sum_{i=1}^{m} \gamma_{1i} (a_i^{+} \Delta EXPN^{+}_{t-i} + a_i^{-} \Delta EXPN^{-}_{t-i}) + \sum_{i=1}^{L} \psi_i (b_i^{+} \Delta Taxes^{+}_{t-i} + b_i^{-} \Delta Taxes^{-}_{t-i}) + + \sum_{i=1}^{s} \lambda_i UM_{it-i} \varepsilon_t \ldots\ldots\ldots\ldots\ldots (2)$$

6- Results and discussions:

7.1. unit root test:

Unit root test is an essential test to choose which model is appropriate for the study, and to reach this goal we have used ADF test. If the variables in the regression model are not stationary, then it can be proved that the standard assumptions for asymptotic analysis will not be valid.

Table3. results of ADF test statistics:

variables	*ADF stationarity test (prob)*		
	level	**1st difference**	**2nd difference**
GDP	0.1195	0.0000	-
Op	0.7006	0.0031	-
Expend	0.1640	0.0022	-
Taxes	0.1721	0.0007	-
Um	0.1096	0.0157	-

Source: eviews11 outputs.

From the table above we notice that all variables are not stationary and have unit root because their probability is higher than the critical value, but at the first difference, all variables became stationary.

7.2. Asymmetric Co-integration test:

for testing co-integration between variables, (Shin et al., 2014) recommended to use joint hypothesis of non-differenced variables and compere their critical value with bound testing of (Pesaran et al., 2001).

The results of Wald test and bound test (in appendix n°1 and n°2) are represented as follow:

Table4. asymmetric cointegration test

Model specification	**Value**				**results**
Nonlinear ARDL Wald test	**Value**	**Probability**		**Critical value**	Co-integration between variables exists.
	9.779215	0.0069		5%	
Linear ARDL Bound test	**Value**	**bounds**		**Critical value**	No co-integration exists
	2.10265	lower bound	Upper bound	5%	

		2.32	3.50		

Source: eviews11 outputs.

From the table above we sign that there is no evidence of co-integration when the linear form is specified, since the F statistics (2.10) is less than the lower critical bound (2.32). Meanwhile the long run relation exists when F statistics (9.77) is bigger than the upper critical bound (3.50) at 5%.

As a final result "Long run relation (co-integration) between our variables exists for NARDL model" because the value of Wald test is bigger than the value of the upper bound of the bound test (9.77 > 3.50).

7.3. Nonlinear ARDL estimation:

NARDL conditions exists, now we move to the estimation (appendix n°3) and the results are explained as followed:

From a quick glance to the output we notice the coefficients of OP, Taxes, expend and Um are not the long run coefficient. To calculate the long run coefficient, we must divide the negative coefficient of each dependent coefficient by the coefficient of GDP (-1). As a result. the long run equation is:

$$\boldsymbol{GDP = 1.0988\, Op_P + 2.0398\, Op_n + 0.1914\, expn_p + 0.3373 expn_n - 4.1974\, taxes_p + 4.2587 taxes_n - 0.9923 Um + U} \ldots\ldots\ldots\ldots \textbf{(3)}$$

R^2=0.96 means that the model is good, because 96% of GDP variations is explained by explanatory variables included in study, only 4% is due to error term. And all variables are significant at 5%.

when government oil prices increase with 1% leads to 1.09% increase in GDP, while when it decreases with 1 % leads to 2.03% decrease in GDP.

Other side, 1% increase in expenditures leads to an increase of 0.19% in GDP, also if it decreases with 1% decreases GDP with 0.33%.

Taxes also has a negative effect on GDP with 4.19% when it increases with 1%, and a positive effect 4.25% when it decreases with 1%

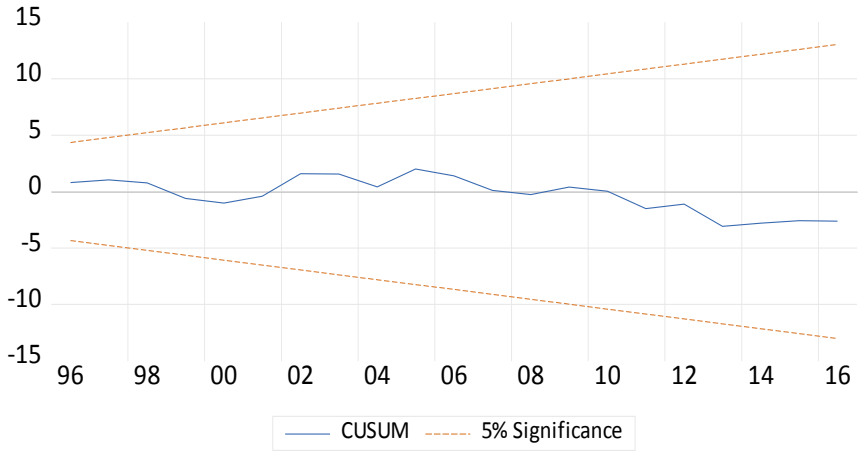
Finally, when Unemployment rate decreases with 1% it leads to 0.99% boost in GDP.

7.4. Stability diagnostics:

The relationship between GDP and the other independent variables is verified using the CUSUM and the CUSUM squared tests.

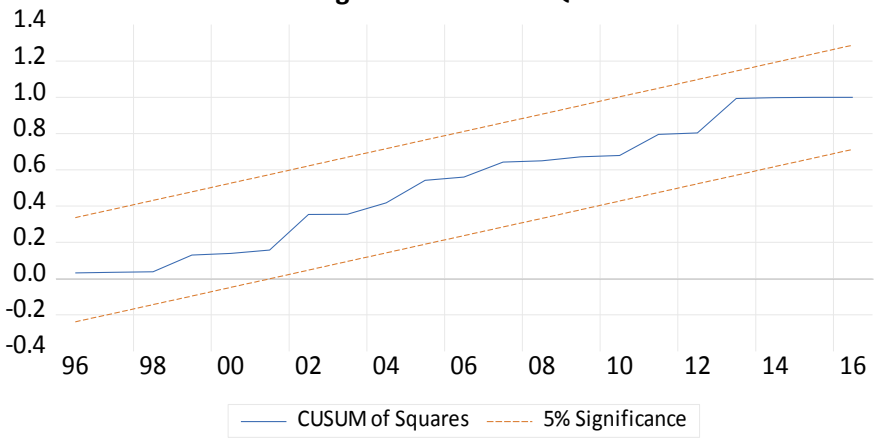
We apply this test on the residuals of the model. We notice that the data as indicated in the two figures fall within the specified range of acceptance (critical bounds), which means that there is a significant Co-integration relationship between GDP and the other variables.

Figure 03. CUSUM



Source: eviews11 outputs**.**

Figure 04. CUSUMSQ



Source: eviews11 outputs**.**

7.5. Results discussion:

The main purpose of this study is to illustrate the effect of government spending in both cases: increasing for expansion policy or decreasing for austerity measures, beside the effect of the other measures taken by the Algerian authorities (increasing taxes cats, and freezing employment) under the oil prices fluctuations.

For the expansionary spending policy, and based on the previous results we can notice that the growth in public spending have a small positive effect on economic growth, that what empirically supports (Fan, Yu, & Saurkar, 2008) results. The reason behind these paraphernalia is the absence of rationalization and the lack of resources in a way that allows the setting up of an alternative economy out of hydrocarbons. Thus, after spending about 800 billion dollars, equivalent to the current value of eight Marshall projects (one of which contributed to the rise of Europe) according to the government's expectations, Algeria will continue to achieve modest growth rates of GDP growth.

Meanwhile, decreasing government spending which refers to austerity has an insignificant effect on economic growth due to the misuse and mismanagement of oil revenues, in addition to the absence of investing in these revenues in a manner, which provides government benefits. This represents an important reason for wastefulness of public spending, where 70% of the total expenditure are heading for the social services. Added to wages a big part of government expenditures focus on strengthening 68% of the total private institutions and enterprises, as well as building basal structures that do not contribute even to enriching and promoting tourism in Algeria. The main reason that led to this chaos is the great dependence on oil revenues as it was a permanent wealth and neglect of industry and production.

Secondly, reducing taxes cuts impacts GDP positively for the reason that reducing cuts it encourages people and corporates to invest, this what was compatible with many empirical studies such as (Gemmell, Kneller, & Sanz, 2014) which marks that decreasing cuts on income tax rates at both the personal and corporate levels yield statistically robust GDP responses of modest size. Both domestic and foreign corporate taxes appear relevant.

However, increasing taxes as a secure way to avoid deficit and debts during oil crisis is similarly not a solution for Algerian financial crisis, although many studies have proved the opposite. Where (Engen & Skinner, 1996) have argued that Tax reforms are sometimes touted to have strong macroeconomic growth effects, even a small effects of increasing taxes cuts can have a large cumulative impact on living standards. The reason behind this contraction is that this increase may diminish the motivation to invest as well as to build capital.

Algeria remains, as it has been for the past fifty years, overwhelmingly dependant on the hydrocarbon sector – a symbol of the oil curse. The sector accounts for 97% of total exports, 63% of government fiscal revenues and 37% of GDP. In such circumstances oil has the biggest part of the GDP growth pie, where it is a strong factor that affects and controls economic growth and economic activity in Algeria. These results come along with the results of (Benramdane, 2017; Moshiri & Banihashem, 2012)

Conclusion:

Public budget policy is an interesting topic, so to produce public services, the government needs money, which it collected from varied sources such as taxes, tariffs, duties, borrowing and deficit financing. The government prepares budget every year and gets approval from the parliament. It has widened the role of government in controlling economic activities of the state.

Therefore, our experiments give a strong evidence for the non-efficiency of spending policy even though it has a small effect on GDP when it's expansionary. Otherwise, taxes are not a good financing instrument and a harmful austerity measure because it has a positive impact on GDP only when it is low. Additionally, the repercussions of the drop in oil prices on the Algerian economy were evident despite the existence of a precautionary financial policy, known as the "Income Control Fund" established by Algeria in 2000 with the start of the oil price boom. However, the oil curse had concealed the weakness of the Algerian economy and policies where the over-reliance oil revenues led to the formation of a single-side economy and supplier, making it vulnerable and very sensible to external shocks. The domestic economy remains vulnerable to external shocks as long as it relies on

oil as the sole source of revenues and revenues. The stability and balance of the Algerian economy requires the Algerian authorities to activate non-oil exports with greater interest in alternative sectors.

Thus, Algerian policymakers should take measures to compensate for the declining share of oil revenues in government revenues. They may consider increasing taxes, import and export fees, energy and other tariffs as rapid remedies to fill the budget but these measures might hurt economic development. Alternative and less harmful remedies would be optimizing government spending, strongly monitoring ongoing projects, and phasing out social and infrastructure projects, which make lower contributions to growth. On the other hand, they must adopt an economic program that focuses on developing agricultural sector as Algeria is a fertile land that can be farming to reach the self-efficiency of food and as result; employment raises and imports will fall. Another part that authorities neglected is investing in the human brain to accelerate the fields of science. Our research opens the way for further investigation of this topic for the oil exporting economies in the future.

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Appendices

Appendix1. Wald test

Wald Test:

Equation: NARDL03

Test Statistic	Value	df	Probability
F-statistic	9.779215	(6, 6)	0.0069
Chi-square	58.67529	6	0.0000

Source: Eviews 11.

Appendix2. Bound test

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.10265	7

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.03	3.13
5%	2.32	3.5
2.5%	2.6	3.84
1%	2.96	4.26

Source: Eviews 11.

Appendix2. NARDL estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	-0.223525	0.164851	-1.355924	0.2239
EXPENDITURES_POS	0.119938	0.060257	1.990446	0.2964
EXPENDITURES_POS(-1)	-0.042846	0.048976	-0.874853	0.0058
EXPENDITURES_NEG	0.424932	0.070352	6.040046	0.1045
EXPENDITURES_NEG(-1)	-0.054160	0.056112	-13.44027	0.0473
TAXES_POS	-0.566905	0.132970	-4.263389	0.0053
TAXES_POS(-1)	-0.449843	0.135833	-3.311735	0.0162
TAXES_POS(-2)	0.937130	0.154920	6.049114	0.0009
TAXES_NEG	-0.518243	0.149583	-3.464584	0.0134
TAXES_NEG(-1)	0.443213	0.128067	3.460793	0.0135
TAXES_NEG(-2)	-0.951883	0.182553	-5.214271	0.0020
UM	0.707767	0.159841	4.427948	0.0044
UM(-1)	0.398745	0.270969	1.471552	0.1916
UM(-2)	-0.221849	0.207554	-1.068873	0.3262
OP_POS	0.089977	0.065088	1.382401	0.2161
OP_POS(-1)	0.602472	0.139727	4.311771	0.0050
OP_POS(-2)	0.245649	0.065680	3.740097	0.0096
OP_NEG	0.239304	0.050480	4.740610	0.0032
OP_NEG(-1)	-0.114259	0.045335	-2.520312	0.0453
OP_NEG(-2)	-0.455961	0.105462	-4.323476	0.0050
C	-8.904056	2.941288	-3.027265	0.0232

R-squared	0.961957	Mean dependent var	3.008111
Adjusted R-squared	0.835145	S.D. dependent var	1.935308
S.E. of regression	0.785779	Akaike info criterion	2.407196
Sum squared resid	3.704694	Schwarz criterion	3.415070
Log likelihood	-11.49715	Hannan-Quinn criter.	2.706890
F-statistic	7.585737	Durbin-Watson stat	3.539348
Prob(F-statistic)	0.009355		

Source: Eviews 11.