

## The impact of oil prices shocks on government spending in Algeria during the period (1986-2019)

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### Abstract:

The aim of this study is to determine the relationship between oil prices shocks and government spending on the Algerian economy within the period 1986 to 2019. Using annual data and employing Granger causality technique between oil prices and government spending, where the results confirm that there is an unidirectional causality from oil prices to government spending, and we use the vector autoregressive model, where the VAR(2) model is with high statistical quality and reliable for analysis, and according to estimates of aggregate impulse response functions, the occurrence of a positive shock in the oil prices, leads to a positive impact on government spending.

**Keywords :** oil prices shocks, government spending, Granger causality, vector autoregressive model, impulse response functions.

**Code classification JEL:** C53, E37, H50

### Résumé:

L 'objectif de cette étude est de déterminer la relation entre les chocs des prix du pétrole et des dépenses publiques pour l'économie Algérienne durant la période de 1986 à 2019. En utilisant la technique de causalité de Granger entre les prix du pétrole et les dépenses publiques, ou les résultats ont confirmé l'uni direction causale des prix du pétrole vers les dépenses publiques, et le modèle du vecteur autorégressif, ou VAR(2) est le modèle approprié avec une bonne qualité statistique fiable pour l'analyse, et les fonctions de réponses impulsionnelles révèle qu'un un choc positif des prix du pétrole a un impact positif sur les dépenses publiques.

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**Mots clés :** choc des prix du pétrole, dépenses publiques, Granger causalité, modèle du vecteur autorégressif, fonctions de réponses impulsionnelles.

**Code de classification JEL:** C53, E37, H50

## 1- Introduction:

Oil revenues represent the pulse of incomes in many Arabic countries, until it became called rentier economies and shifted from the assumption that the power economy had oil to a fragile economy as a result of the collapse of oil prices in world markets, which poses a threat to its economy. The great drop in oil prices in mid-eighties, specifically in 1986, and the declining value of dollar led to the loss of economic policy of balances, due to the lack of alternative revenues for fuels, in order to finance the investments.

The government spending policy is a part of fiscal policy, because of its impact on aggregate demand with Keynes considers, the most effective tool for addressing macroeconomic instability, and thus the importance of the government spending policy as a tool of economic policy that can be used to achieve macroeconomic stability and the modern theory of public finance, goes to study the nature of government spending and its economic implications

The Algerian government spending huge sums of money on the expansion of spending policy to revive and revitalize the economy.

In this research paper, we discuss the relationship between oil prices and government spending in Algeria through the statistical data of each of them from 1986 to 2019, by answering the following question: How much effect do price fluctuations affect government spending in Algeria?

In order to study this problematic, we formulated the following hypothesis:

H<sub>1</sub>: The government spending is directly affected by the shocks in oil prices in Algeria.

H<sub>2</sub>: There is a statistical relationship between oil prices shocks and government spending in Algeria.

In order to answer this problem and test the hypothesis we divided the research into the following axes.

## **2- Theoretical framework of the study:**

The Algerian economy is considered an oil economy, as the oil sector generally considered the backbone of this economy, it produces more than two thirds of national wealth, while fuel exports are the main driver of the national economy's indicators, as it represents more than 95% (Benbitour, 1999).

### **2-1. Definition of government spending:**

The government spending is defined as the amount of money spent by the stat to satisfy public needs and to achieve its economic and social intervention (DRAOUSSI M, 2005-2006 p 347).

### **2-2. Definition of oil price:**

The oil price is defined as the expression of the value of a commodity in a specific period time (2003, *الدويري*). It also refers to the spot price to the barrel (159 liters) of benchmark crude oil.

### **2-3. Oil shocks:**

An oil shock corresponds to a massive and rapid increase in the price of oil which generally triggers a crisis for countries that are dependent on imports. Oil shocks are due to different reasons, either economic or political. The increase in prices can arise from poorly anticipated demand which causes an imbalance on producing countries to impose high prices (CORPENCHI, 2010).

## **3- Previous empirical studies :**

- (HAMDIA, BIAB, 2013) have presented a study entitled: dynamic relationship between

oil revenues, government spending and economic growth in an oil dependent economy, the objective of the study is to present an empirical study for the dynamic relationship between the oil revenues, the government spending and economic growth in kingdom of Bahrain, where the oil revenues are the principal source of government spending financing in this country, the researchers used the methodology of co-integration analysis and error correction model for data from 1960 until 2010. The statistical results shown that the oil revenues are the principal source of economic growth and the fundamental channel which finance the government spending in the kingdom of Bahrain.

- (DISARI, 2013) has studied the dynamic relationship between government revenues and government spending in Iran, with the aim of

knowing the effect of oil prices on this relationship. The result of the impulsion response functions and analysis of variances indicated that the shocks of oil prices contributes to the interpretation of government spending through the autoregressive vector model and correction error vector model.

- (ADEDOKUNA, 2018), has employed data from 1981 to 2014 to investigate the effects of oil shocks( price and revenues) on the dynamic relationship between government revenues and government expenditures in Nigeria and how it transmits effect on major macroeconomic variables using the SVAR on key variables and vector error correction model, the results shows in short run fiscal synchronyzation hypothesis is evident between the oil revenues and total government expenditures, it is also evidenced that oil shocks highly affect policy variables, the study suggests expedient government actions to redirect the economy from oil revenues towards diversifications.

- ( RAKRAK, AMRANI ,2017) have studied the effects of oil prices shocks on government budget in Algeria, they examines the consequences of the oil price volatility on government budget of the Algerian economy within the period 1970-2014, employing granger causality technique in Algeria, by identifying the direction of causality between oil prices (the positive shocks to oil prices and the negative shock oil prices) and economic indicators for fiscal policy, the study found that the direction of causality from real oil price changes the government spending.

- (BOUALKOUR, SOFANE, 2017) have studied the impact of fluctuations in oil prices on government spending in Algeria during the period 1980-2014, the aims of their study was to identifying the effects of the oil price fluctuations in Algeria on government spending in the short and long term, using ARMA(p,q) and ARIMA(p,d,q) models, box-Jenkins methodology, ARCH models, their study concluded that Algerian fiscal policy is characterized by periodicity, the positive shock in oil price fluctuations has a positive effect on government spending and vice versa in case of negative shock.

From the previous studies, we note that all studies have found that rising oil prices have a positive impact on public spending, but there is a discrepancy regarding the cointegration relationship between the two variables. Some studies have found a long-term relationship between public spending and oil price shocks, while others have found the

absence of this relationship in the long term and its limitation to the short term, and this can be explained by the difference in the study period as well as the difference in standard models.

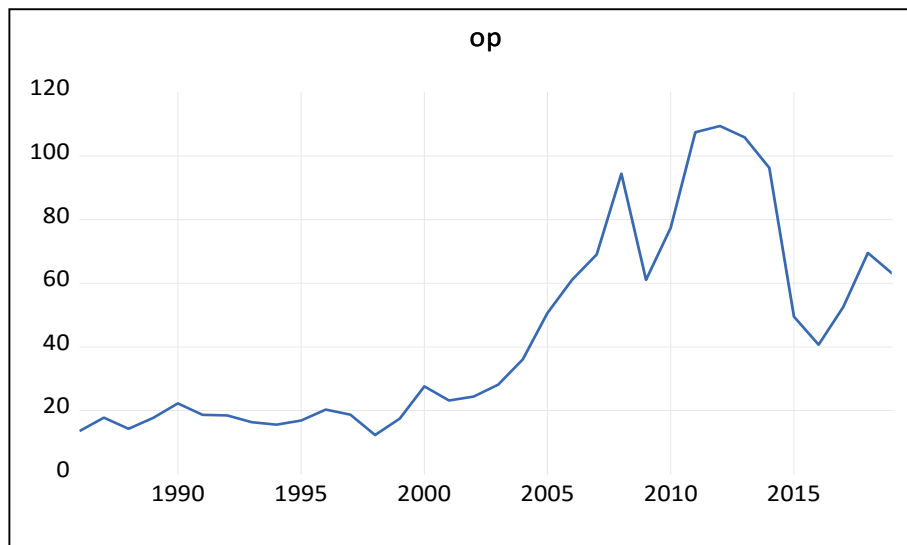
That is why we decided in this study to learn about the relationship in relation to the case of Algeria in the period extending from 1986 until 2019.

### 3- Econometric study:

Through this econometric study, we will try to find out the effect of oil prices shocks on the government spending in Algeria from 1986 to 2019, so we use annual data covering the period, which were obtained from various official sources, represented by the OPEC and the ministry of finance of Algeria.

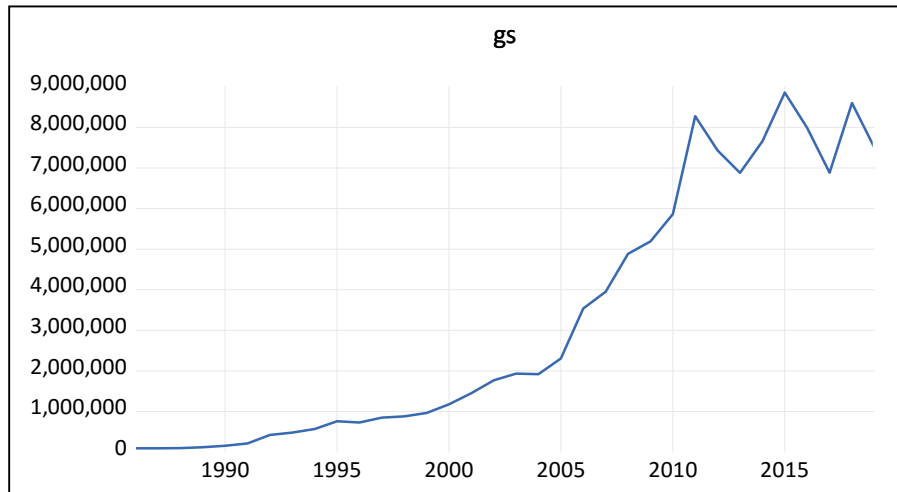
At first, we will examine the graph of the oil prices time series and the graph of government spending time series as shown in figures N°1 and N°2:

Figure N°1 (graph of oil prices)



Source : (Eviews 11 program outputs)

Figure N°2 (graph of government spending)



Source : (Eviews 11 program outputs)

The graphs of oil prices time series and government spending time series have trend, so we conclude that the time series are not stationary.

### 3-1. Study of the time series stationarity of variable:

To study the stationary of the time series of variables oil prices (OP) and government spending (GS), we use the augmented (DICKEY, 1979) test at the level of significance of 5%, and the results obtained are listed in table N°1 below:

TableN°1 ( Augmented Dicky-Fuller test results)

| variables/<br>test                             | In level          |                   |                   |                   |                           |                   |
|------------------------------------------------|-------------------|-------------------|-------------------|-------------------|---------------------------|-------------------|
| ADF<br>Augmente<br>d Dicky-<br>Fuuller<br>test | None              |                   | Constant          |                   | Constant, linear<br>trend |                   |
|                                                | $t_{cal}$         | $t_{tab}$         | $t_{cal}$         | $t_{tab}$         | $t_{cal}$                 | $t_{tab}$         |
| <b>OP</b>                                      | -<br>0.3145<br>73 | -<br>1.9513<br>32 | -<br>1.3978<br>28 | -<br>2.9540<br>21 | -<br>5.3605<br>35         | -<br>3.6032<br>02 |
| <b>GS</b>                                      | 2.2468<br>38      | -<br>1.9550<br>20 | 2.0281<br>54      | -<br>2.9862<br>25 | -<br>2.2448<br>32         | -<br>3.6032<br>02 |
|                                                | 1st difference    |                   |                   |                   |                           |                   |
| ADF<br>Augmente<br>d Dicky-<br>Fuuller<br>test | None              |                   | Constant          |                   | Constant, linear<br>trend |                   |
|                                                | $t_{cal}$         | $t_{tab}$         | $t_{cal}$         | $t_{tab}$         | $t_{cal}$                 | $t_{tab}$         |
| <b>DOP</b>                                     | -<br>5.0867<br>80 | -<br>1.9516<br>87 | -<br>5.0464<br>47 | -<br>2.9571<br>10 | -<br>4.9662<br>03         | -<br>3.5577<br>59 |
| <b>DGS</b>                                     | 0.2504<br>72      | -<br>1.9556<br>81 | -<br>0.8854<br>25 | 2.9918<br>-78     | -<br>4.1654<br>86         | -<br>3.6032<br>02 |

Source : (Eviews 11 program outputs)

In light of the results shown in the above table, it is clear that the time series of the variable oil prices (OP) is not stationary in the level because the calculated value of the student statistic is greater than the tabular value of Dicky-Fuller, at the level of significance of 5%, but is stationary in the first difference, because the calculated value of the student statistic is less than the tabular value of Dicky-Fuller, at the level of significance of 5%, but stationary in the first difference (DOP), at the level of significance of 5%, and that the time series of the variable government spending (GS) is not stationary in the level because the calculated value of the student statistic is greater than the

tabular value of Dicky-Fuller, at the level of significance of 5%, but is stationary in the first difference (DGS), because the calculated value of the student statistic is less than the tabular value of Dicky-Fuller, at the level of significance of 5%, but stationary in the first difference, at the level of significance of 5%. However, we can conclude that there is a possibility of cointegration between the two variables, so we use the Angle Granger test which consist in :

Phase 1: on estimating the long run relationship between government spending and oil prices, the results are listed in **Table N° 2** below:

**Table N° 2 (long run relationship between government spending and oil prices )**

| Variable | Coefficient | t-stat                | prob    |
|----------|-------------|-----------------------|---------|
| C        | 0.580982    | -2.17 <sup>E-06</sup> | 0.00218 |
| OP       | 0.284684    | 4.09 <sup>E-06</sup>  | 0.00397 |

Source : (Eviews 11 program outputs)

**Phase2: stationary test residuals series by augmented Dickey-Fuller test as it is recommended by Angel Granger.**

**Table N° 3 (ADF test for Residual series)**

| variables/<br>test                             | In level          |                   |                   |                   |                           |                   |
|------------------------------------------------|-------------------|-------------------|-------------------|-------------------|---------------------------|-------------------|
| ADF<br>Augment<br>ed Dicky-<br>Fuuller<br>test | None              |                   | Constant          |                   | Constant, linear<br>trend |                   |
|                                                | t <sub>cal</sub>  | t <sub>tab</sub>  | t <sub>cal</sub>  | t <sub>tab</sub>  | t <sub>cal</sub>          | t <sub>tab</sub>  |
| The<br>residuals<br>series                     | -<br>0.4465<br>61 | -<br>1.9513<br>32 | -<br>2.6133<br>02 | -<br>2.9540<br>21 | -<br>1.9578<br>21         | -<br>3.6032<br>02 |

|  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
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Source : (Eviews 11 program outputs)

In light of the results shown in the Residuals series are not above table, it is clear that stationary in the level because the calculated value of the student statistic is greater than the tabular value of Augmented Dicky-Fuller, at the 5% level of significance. So, the residuals series contain unit roots and thus they are not stationary at level, therefore there is no cointegration between the government spending variable and oil price variable. We will use the VAR model.

### 3-2. Study of causality between variables:

To determine the direction of the relationship between oil prices (OP) and government spending (GS), we use the granger test causality, but before this, we determine the number of lag which is appropriate to the VAR(p) model of the variables in the form of differences, which are chosen from different criteria using the eviews 11 program, and we reached the results presented in the following table N°4:

**Table N° 4 (VAR lag order selection criteria)**

| VAR lag order selection criteria | 0        | 1        | 2        |
|----------------------------------|----------|----------|----------|
| Akaike information criterion     | 41.44194 | 38.11145 | 38.00388 |
| Schwartz information criterion   | 41.43355 | 38.56950 | 28.27871 |

Source : (Eviews 11 program outputs)

From the results shown in the above Table N°4, it becomes clear to us that the optimal lag order is  $p=2$ , and from there the test conducted accordingly, and the test results are shown in table N°5:

**Table N°5 ( Granger causality test results)**

| Pairwise Granger Causality Tests |     |             |        |
|----------------------------------|-----|-------------|--------|
| Null Hypothesis:                 | Obs | F-Statistic | Prob   |
| OP does not Granger Cause<br>GS  | 31  | 4.36508     | 0.0137 |
| GS does not Granger Cause<br>OP  | 31  | 1.86645     | 0.1622 |

Source : (Eviews 11 program outputs)

We conclude from this, that there is a causal relationship between oil prices (OP) and government spending (GS) in one direction at the level of significance of 5%, which is from oil prices to government spending, because probability is equal to 0.0137 is less than 0.05.

### 3-3. Estimation of the VAR model :

We have previously determined the appropriate number of lag of the VAR(p) model , we found p=2, and to estimate the VAR(2) model, we use the ordinary least square method, and the results are shown in table N°6:

**Table N°6 (VAR(2)estimates results).**

|                      | GS               | OP                          |
|----------------------|------------------|-----------------------------|
| <b>GS(-1)</b>        | <b>0.580982</b>  | <b>-2.17<sup>E</sup>-06</b> |
| <b>GS(-2)</b>        | <b>0.284684</b>  | <b>4.09<sup>E</sup>-06</b>  |
| <b>OP(-1)</b>        | <b>18316.75</b>  | <b>1.010907</b>             |
| <b>OP(-2)</b>        | <b>-2265.448</b> | <b>-0.276015</b>            |
| <b>C</b>             | <b>27239.38</b>  | <b>7.51993</b>              |
| <b>R<sup>2</sup></b> | <b>0.96</b>      | <b>0.82</b>                 |

Source : (Eviews 11 program outputs)

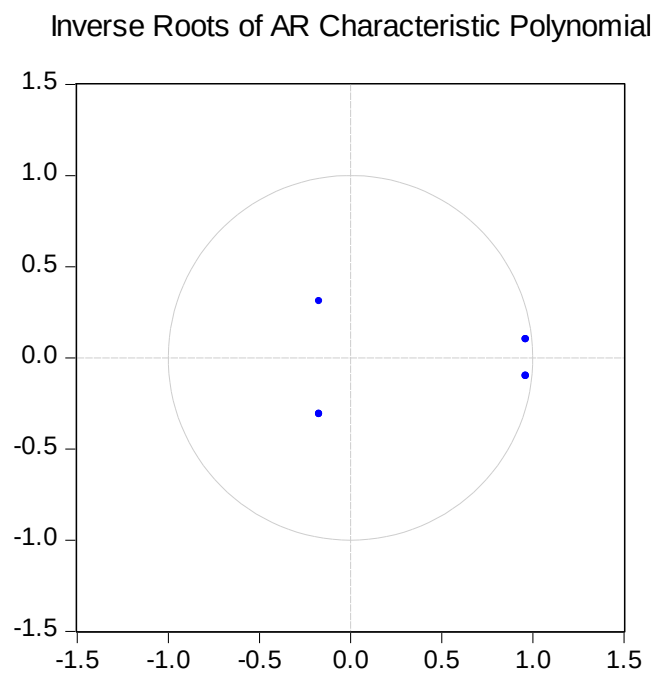
### 3-3-1. Model validity test :

In order to ensure the validity of the VAR(2) model, we have to make sure that is free from econometric problems and does not contradict the economic theory, we will do a statistical evaluation for the estimate VAR(2)model:

### 3-3-1. test of stability of VAR(2) model:

The results of the test are shown in figure N° 3;

**Figure N°3:**



Source : (Eviews 11 program outputs)

Since all the roots of characteristic polynomial are distinct in the unit circle, then the model is stable.

### 3-3-2. VAR residual serial correlation test:

The test results are shown in table N°7:

**Table N°7 (The LM test results)**

|                                                       |
|-------------------------------------------------------|
| VAR Residual Serial Correlation LM Tests              |
| Null Hypothesis: no serial correlation at lag order h |

| Lags | LM-Stat  | Prob   |
|------|----------|--------|
| 1    | 1.160900 | 0.8845 |

Source : (Eviews 11 program outputs)

We note from the table (5) that  $prob(LM) > 0.05$ , so we accept the null hypothesis, and then there is no serial correlation.

### 3-3-3. Test of heteroskedasticity:

We use the White test, and the results are shown in table N°8:

**Table N°8 (The White test results)**

| VAR Residual Serial heteroskedasticity WhiteTest   |    |        |
|----------------------------------------------------|----|--------|
| Null Hypothesis: no heteroskedastic at lag order h |    |        |
| CH-SQ                                              | Df | Prob   |
| 43.73451                                           | 24 | 0.4807 |

Source : (Eviews 11 program outputs)

We note from the table N°6 that  $prob(CH - SQ) > 0.05$ , so we accept the null hypothesis, and then there is a stability of error variance..

### 3-3-4. Statistical interpretation of results:

We concluded from table N°4, the equations of study variables:

#### 3-3-4-1. government spending's

##### equation:

$$GS = 0.580982 * GS(-1) + 0.284684 * GS(-2) + 18316.75 * OP(-1) - 2265.448 * OP(-2) + 27239.38$$

$R^2 = 0.95$   
 $N = 32$

Through the government spending equation, we draw the following results:

- positive relationship between government spending and its value in one period and two period and the value of oil prices in one period
- negative relationship between government spending and the value of oil prices in two period.

- explanatory power of the model is 96%.

### 3.3.4.2-Oil prices's equation:

$$\text{OP} = -2.17\text{E-}06 * \text{GS}(-1) + 4.09\text{E-}06 * \text{GS}(-2) + 1.010907 * \text{OP}(-1) - 0.276015 * \text{OP}(-2) + 7.519923$$

$R^2 = 0.82$   
 $N = 32$

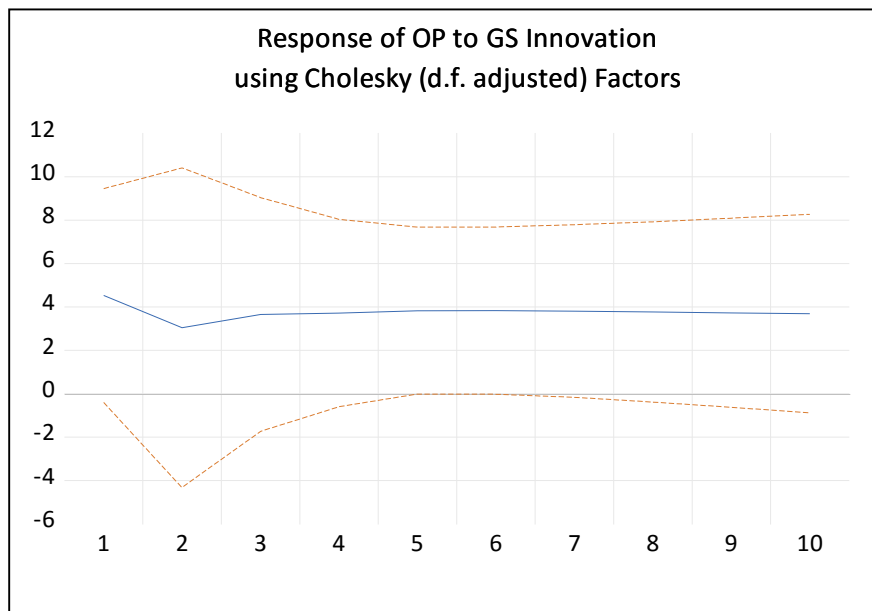
Through the government spending equation, we draw the following results:

- positive relationship between oil prices and its value in one period and two period value of government
- negative relationship between oil prices and the value of oil prices in two period, and in one and two period government spending's value. .
- explanatory power of the model is 82%.

### 3-3-5. The impulse response functions results:

The impulse response functions results are presented in figure N° 4 bellow:

**Figure N°4:**



Source : (Eviews 11 program outputs)

We use impulse response function, which outline the dynamic response of a one standard deviation shock in a variable on current and future value of the variables, in order to capture the short run dynamic s on the model. It can also provide information on the periode by which variables go back to the equilibrium a shock following a shock in the long run relationship.

The chart above illustrates the response of each variable of the VAR model and the impact of other variable. It shows that the response of an occurrence of a positive shock in the oil prices estimated at 1% , leads to a positive impact about 4.53% in the first year and then, decrease to 3.82% in the fifth year, and it falls down to 3.68% in ten year.

Finally, in the line with the occasional periodicity of financial policy, because in Algeria the government spending policy is closely related to shocks in oil prices, where the fiscal policy response to the high oil prices would be to increase government spending, on the other hand, a negative shock in oil prices has a negative impact on government spending due to the large correlation of government spending with public revenues that depend on petroleum taxation.

#### **4- Conclusion:**

Trough this research paper, we tried to highlight the main goal of the study which was the phenomenon of the impact of oil prices shocks on government spending during the period 1986-2019, using the methodology of vector autoregressive, which is a simultaneous equation where the contemporary value of a variable depends on its ownpast values and the past value of the other variables. The VAR (2) is the appropriate model for our study, and we find that the Algerian government spending is greatly affected by oil prices. With regard to the first hypothesis which states that The government spending is directly affected by the shocks in oil prices in Algeria is true, because Algeria depends on hydrocarbons as the only sector providing money, and the second hypothesis which state that There is a statistical relationship between oil prices and government spending, is also true and this is achieved trough results of VAR(2).

#### **The study results:**

-Algerian government should not rely a single resource that is the oil whose price will be held hostage to the global markets that give rise to shocks.

-Trough the econometric study, it can be concluded that the VAR (2) model Through the government spending equation, we draw the following results: positive relationship between oil prices and its value in one period and two period value of government and negative relationship between oil prices and the value of oil prices in two period, and in one and two period government spending's value. The explanatory power of the model is 82%., so the model is with high statistical quality and is reliable for analysis.

**The recommendations:**

- Working to reorient government spending through attention to areas that improve the growth of national production capacities.
- Diversify the economy.

**The prospect for the study:**

-Rationalizing government spending in Algeria in light of oil prices shocks.

- Economic diversification policies in Algeria and their role in reducing oil prices shocks.

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