Proposing the Method to Predict the Break-Even Oil Price for Hedging and Sustainable Finance in Oil Exporting Countries:

An Empirical Study in Algeria by using the Black-Scholes Model

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Paper proposal entitled:

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Abstract:

Oil-exporting countries suffer from the volatility of oil prices, especially in the recent period, which makes them vulnerable to risk trying to find a hedging strategy. This paper aims to propose a new method to predict the fiscal breakeven oil price, for oil-exporting countries based on an empirical study using the Black-Scholes model in Algeria. To achieve our examination we use the oil prices with daily data during the period of 2013 to 2019, the fiscal breakeven oil prices and external breakeven oil prices from 2000 to 2020, which are determined by the International Monetary Fund (IMF); in addition to the fiscal breakeven oil prices of Algeria. The main results of our study highlight that there is a strong correlation between the fiscal breakeven prices based on the Black-Scholes model and the external breakeven price, and weak correlation with the IMF's fiscal breakeven prices, which means that the Black-Scholes model is outperforming to predict the fiscal oil prices in comparison with the IMF method. The results also indicate that there is a negative correlation between the B-S and the reference prices indicated in Algeria's public budget.

Keywords: Financial sustainability, break-even price, options prices, Black-Sholes model, hedging, public budget.

JEL classification: C02, H00, H30, H61

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I.   Introduction

Fiscal Breakeven oil prices have become popular and important among analysis and making policy decisions for most of the oil-exporting countries, this price appeared in October 2008 by the IMF when it started to calculate it after the global crisis. These countries used the fiscal breakeven oil price as an indicator to forecast the instability such as Russia and Iran while Saudi Arabia cut its production in order to avoid the decline in oil prices under the Fiscal Breakeven oil price. Building on that we can say that this price can be used to shape oil-exporting countries' behavior and Algeria one of these countries. Oil-exporting countries insist on balancing their budget using the fiscal breakeven oil prices, which can be useful for the geopolitical and market analysts. In addition to the policymakers who are trying to shape oil-exporting countries' behavior, wherein high oil prices is one of the big factors that may negatively affect the fragile global economy (y .Akira, 2019) In the GCC and North Africa oil exporting countries proved by (Leando. M, (2012); Brad.W S and Cole V.V, (2017), Abdullah.S et al, (2018), Assil.M and Majda, (2018),Selim Cakir, (2019).

Since 2014, Algeria is facing a dramatically reduction in the revenues adopted as a result of the decline in oil production and the decline in prices on the other hand; which led to the decline of the exchange reserves significantly. Despite the recent recovery in oil markets because of the OPEC agreement to cap production, Algeria is concerned about the volatility in oil prices because it is setting a reference price that meets the expectations of oil prices. However, Algeria's policy of setting a reference price commensurate with this volatility remains unclear to experts and researchers in this field; in addition, the method of the International Monetary Fund in calculating the break-even prices are not applied by Algeria experts. As well as it does not take into consideration, the oil prices and it relied on this method only on costs.

The oil prices characterized by the high volatility in global markets because of many reasons such as the oil production in all of the word, the demand of the importing countries the political crises and other factors which influence the oil prices, (Gillian.M&al, (2014), Arifah.B&al, (2017), (Focacci.A, 2019) proposed some mathematical method to predict the breakeven prices. The oil prices have known many crises and shocks since 1970s; when the organization of petroleum exporting countries (OPEC) decided to reduce the production in order to stabilize the oil prices on high-level in1982. However, this strategy was not successful because of the instability in oil markets. In 1986, the oil prices known a remarkable depression, which led to taking a decision to rob the prices.

In 1990, the oil prices have known a positive crisis because of the reducing of the production after four years oil prices decreased to weak levels. In 1999 the oil prices augmented again wherein the main cause of this augmentation is the OPEC decision to reduce the production to 3 million barrel per year, in addition to the resolution of the Asian countries and it's consumption of the petroleum, at the beginning of 2007 the oil price reached 90$ per barrel because the stoppage of Venezuela worker and the rapid growth of the Asian economies and the Iraq war.

In 2008 oil prices have known a new depression when it reached 55$ because of the financial crisis, in 2011 the prices augmented again to 90$ because of the Arab spring in Libyan

which led to the reduction of the petroleum production, the prices continued to the augmentation till the mid of 2014 when the oil prices have known remarkable depression in global markets while the prices decreased from 110-80$ per barrel in 2012-2013 and from 80-60$ in 2015-2017 This shock led to draw down 200$ billion foreign exchange reserves to shore up its economy, which makes Algeria in a weakness and suffers from the instability economic and reduces all the development indicators.

Most of the resources exporting countries especially oil-exporting countries suffer from the resource curse. Algeria's economy and other oil-exporting countries such as the Middle East, Latin America characterized by weak economic and social development also the high level of corruption and the weak health, education and political systems compared with the rest of countries which are less well endowed with natural resources.

There are several differences between energy commodity markets and the traditional financial security markets, among these differences the lack of the same level of liquidity that the majority of financial markets enjoy, other difference is the storage costs of most commodities translate into peculiar price behavior, in addition to the higher volatility in their prices and the crisis series.

In the mid of 2014 the oil prices have known a remarkable decreasing from 80-110 per barrel from 2011 to 2013 and to 60$- 40$ per barrel from 2015 to 2017. Algeria is one of the countries which rely on the hydrocarbon sector on its revenue; while the hydrocarbon revenues represent 97% of exports, 30% of GDP, and 60% of the public budget according to IMF reports. The collapse of the oil prices and Gas prices has fettered the Algerian economy at the time of degenerating security conditions in Northern Africa. This situation makes Algeria in a weak position because of the absence of diversification in revenue resources. (Chekouri.S.M&al, 2017)

Sustainability of public finance has become the most important topic in all the natural resource countries. This term related to hydrocarbon revenues in these countries because it presents the main financial resource of the public budget. Fiscal sustainability based on some important factors to realize it and strengthen it, by using the crucial indicators before and after happening in order to avoid the financial crises. Its dimensions give an important to measure the ability of the government to settle its obligations and financing it expenses using the auto resource especially the fiscal revenue, so the financial sustainability based on the long term without the risk of collapse.

The rest of the paper organized as follows: section two is the literature review, section three represents the data and methodology, and section four shows the results, finally section five represents the discussion and conclusion.

The large volatility in oil prices have led to the deterioration of the economy of many oil-exporting countries, especially the Algerian economy, and consequently the impact on their fiscal policy in the financial budgeting where the reference price represents an important variable public budget.

✓ **Motivations:**

1- Proposing the new method for determining the break-even oil prices in oil-exporting countries.

2- Examine the performance of the Black-Sholes model to determine the break-even oil prices, and make a comparison between the Black-Scholes model result and the IMF prices.

3- Testing the validity of the Black-Sholes model to predict the options prices, using oil prices.

4- The possibility to create a hedging position in front of the high level of volatility of oil prices and realized the economic stability.

5- Finding the appropriate rational approach for predetermining the breakeven of oil prices and building an equivalent budget.

II.   Literature review:

Researches regarding the fiscal breakeven oil prices have a large increase in the least years. (Leando.M, 2012), focused on the measuring of fiscal risk in hydrocarbon in exporting countries, the investigation used the stochastic simulation method and the oil prices, breakeven prices as data, in the Middle East and North Africa for oil-exporting countries as a sample. They conclude that countries; which have large net assets and proven oil reserves are much less vulnerable to the fiscal risk that, also its indicates by the standard measures based on breakeven prices. While the study of (Gillian.M&al, 2014) talk about breakeven volatility for the real option valuation. Where they conclude that industry volatility based on stock prices is not practical for real option as it is in financial options analysis; in addition, they provide that the project should be abandoned because it may be riskier when the breakeven volatility is greater than the industry average. (Brad.W S and Cole V.V, 2017); try to investigate on the external breakeven oil price to track vulnerabilities in oil-exporting countries. In the beginning, this paper we find a brief story of the oil prices volatilities since the global crisis 2008, after that the authors give a clear explanation of the external breakeven price and some calculation limits of this price; most important of them is the lack of exchange rate on the formulas used to calculate it. It is clear from a discussion that the External breakeven price has more advantages over the fiscal breakeven calculations where it is not difficult to verify the inputs, and this required inputs characterized by the consistent across countries which make it easy to make the comparison. Moreover, the authors move to determine the determinants of the external breakeven oil price which are; the oil prices, a limited number of readily the current account (including investment in income on assets aboard) in addition to the net income of oil exports. Despite all these benefits the IMF and all the oil-exporting countries do not take on account these prices for balancing the budgets. (Arifah.B&al, 2017), aim to forecast model for crude oil price with a structural break, based on GBM and Mean reverting Arnstein Uhlenbeck process during the period of 1986 to 2016, the main result showed that forecasting crude oil is highly accurate for short term under GBM in comparison with Mean reverting Arnstein Uhlenbeck process. (Abdullah.S et al, 2018) present them investigation about oil prices, domestic resource gaps, and breakeven oil prices in the oil exporting countries taking Saudi Arabia as a sample. The authors try to examine the impact of the oil prices and domestic resource gaps; in addition to the external fiscal oil breakeven prices in oil-exporting countries covering the period of 2008-

2018. Using linear and non-linear regression model, the main results of this examination show that there is a significant effects on the economic growth in Saudi Arabia, also they find that the fiscal breakeven oil prices is high with 2.35$/barrel as a marginal. Furthermore, the oil prices have a co-movement with the domestic resource gaps. The contribution of (Assil.M and Majda, 2018), focuses on the fiscal sustainability challenges in the new normal of low oil prices. Based on empirical study from the GCC countries; this paper aims to test the reaction of fiscal sustainability against the augmentation of the public debt after that, the authors compare results of some similar and non-similar groups in order to understand the effect of the macroeconomic variables on the fiscal policies responses during the fluctuation of the oil prices. This paper also gives some explanations about the results, which are; the GCC countries issue more debts in order to ensure a fiscal sustainability policy. The variation between the breakeven oil prices has a high impact on the fiscal performance; so the successive depression of the oil prices and the openness warrant more efforts to reform the budget in the GCC countries. While the discussion paper from the council on foreign relations written by (Jorge de León Miranda and Selim Cakir, 2019); focuses on the fiscal breakeven oil prices; usage, abuse and the opportunities of improvement in 2019. According to the author, the breakeven price can provide the countries by the right political insight. It can also help the decision makers in the oil-exporting countries to control the situation by raising the revenues or decrease the spending. The breakeven prices give the governments a clear vision for the oil market, whereas, it can reveal the variation on the oil production according to the decisions. Aissaoui Ali senior consultant APICORP[*] shows that according to the official sources governments are thought to have based on the petroleum fiscal revenues to build their budget. In this commentary, he tries to revising and refine a model for calculating the fiscal oil prices in the contest of the changing on the budget and moving to a political vision when we talking about this prices which expressed as a "fiscal cost curve" and focusing on the fiscal sustainability in the short term . The second part of this commentary was specialized in talking about the modeling of the fiscal breakeven oil prices; when the author gives a small definition of this price and the main determinants used to predict it; such as the production and export volume. These determinants are the crucial parameters of the revenues governments receive from royalty and petroleum taxes; the non-hydrocarbon fiscal receipts in addition to the investment income from the current account complement those revenues. According to the author the expenditures should equal the fiscal revenue from the hydrocarbon plus the Non-hydrocarbon fiscal revenue plus any transfer from sovereign wealth fund (SWF) and fiscal stabilization fund (FSF). The author focused on an important point in the Fiscal Breakeven price model when the exchange rate are ignored in the construction of the model because the fiscal revenues are generally paid in dollars while the government budget is run in national currency. The study of (Focacci.A, 2019) investigate on multi-breakpoint analysis of crude oil prices, he tries to propose a quite different approach to detect more than a single structural break. The author concludes that the applied method indicates a good potential for further empirical investigation within economics of the commodity markets.

All of the previous literature reviews investigated on the calculating of the breakeven prices based on the intern factors and ignoring the external variables such as the oil prices and volatility without focused on proposing hedging strategies against this instability in oil markets.

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III.   Data and methodology:

Our paper aims to predict the fiscal Break-even oil prices using crude oil prices collected from ***Thomson Reuter's*** database from 02/01/2013 to 09/04/2019 with daily data. In order to achieve our hypotheses we will use the Black-Sholes model as a benchmark model to evaluate the options prices, in addition to the risk-free rate, which is collected from the Federal Reserve Bank, as well as the fiscal-external breakeven oil prices. The rest of the variables will calculated based on our data.

Before to starting our empirical study we will present the theoretical background of the Black-Scholes model and the most important assumptions, in addition to the presentation of some definition of the Fiscal Breakeven prices and some formulas to calculate it.

1-   The Black-Sholes model:

The Geometric Brownian Motion process or the B-S model is one of the famous discreet time models; which detects the changes of the theoretical fair value of an option(Roman, 2004, p. 237). This model is one of the most popular models in mathematical finance, although it's criticism and limits which contravenes with the reality of markets and their characteristics especially the emerging markets known by the high volatility and the rapid changes in their mechanisms. In 1973's the Physicists Black Fisher and Myron Scholes presented a new formula to evaluate the European option type under some assumptions, which assume the ideal conditions for stock and for options.

2-   The assumptions of the B-S model
- a- The risk free rate is known and constant,
- b- The volatility is constant,
- c- The stock price follows a random walk in continuous time;
- d- The log-Normal distribution of the stock prices;
- e- The absence of the dividends or other distributions;
- f- The option is European;
- g- There are no transaction costs;
- h- There is no arbitrage opportunity,
- i- There are no penalties for short selling.

The Black-Sholes formula:

$$C(S,t) = S\ N(d_1) - Ke^{r(t-t^*)}N(d_2) \qquad (1)$$

$$d_1 = \frac{\ln S/K + (r + 0.5\upsilon^2)(t^* - t)}{\sigma\sqrt{(t^* - t)}} \qquad (2)$$

$$d_2 = \frac{\ln S/K + (r - 0.5\upsilon^2)(t^* - t)}{\sigma\sqrt{(t^* - t)}} \qquad (3)$$

We can write the put option formula as follow: **(Black-Scholes, 1973, pp. 644-642)**

$$P(S,t) = Ke^{r(t-t^*)}N(-d_2) - SN(-d_1) \qquad (4)$$

In order to achieve our investigation about the testing of the validity of the Black-Scholes model to predict the fiscal breakeven oil prices we will put the next hypotheses:

3-   Hypotheses:

1- The Black-Sholes model is valid to predict the fiscal breakeven prices.
2- The Black-Sholes model results converge to the fiscal breakeven prices.

The fiscal breakeven oil price has recently become a Controversial topic for economists, especially after the severe crisis in oil prices, which shocked the oil exporting countries, which depend heavily on oil revenues. Below is a brief introduction to the breakeven price and its calculation formulas.

4-   Fiscal Breakeven price (BEP):

Fiscal Breakeven oil price is the minimum price per barrel that the country needs in order to meet its expected spending needs while balancing its budget. In other word oil prices under this price should result in a deficit in the budget unless government policies change. The figure above represents the development of fiscal oil prices from 2000 to 2020 for nine oil-exporting countries (the Middle East and North Africa).

Figure 01: The fiscal Breakeven prices for some oil exporting countries in the Middle East and North Africa.

Fiscal Breakeben oil prices 2000-2020
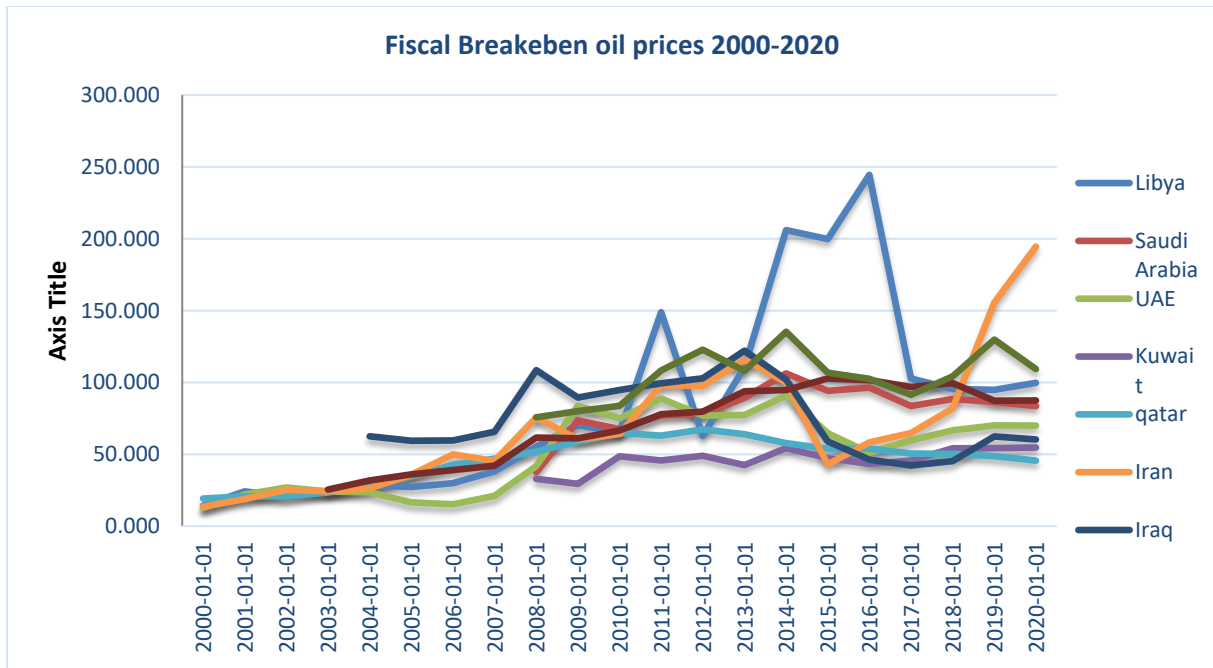
Source: Authors using www.fred.stlouisfed.org. (IMF).

The table above shows the development of the Fiscal Breakeven prices for the oil-exporting countries from 2000 to 2020; we can observe that Libya's Fiscal Breakeven prices are the higher than the other countries wherein it determined by 244,47 followed by Iraq and Iran, because of the effect of the Arab Spring and the augmentation on risk premium. In addition, we note that during the crisis, the fiscal breakeven prices rose, indicating the significant impact of oil price volatility on the breakeven prices.

Since oil prices have a major role in determining the breakeven prices, the following figure shows the volatility of oil returns during the study period.

Figure: 02 the volatility oil returns during the period of study (2013-2019)
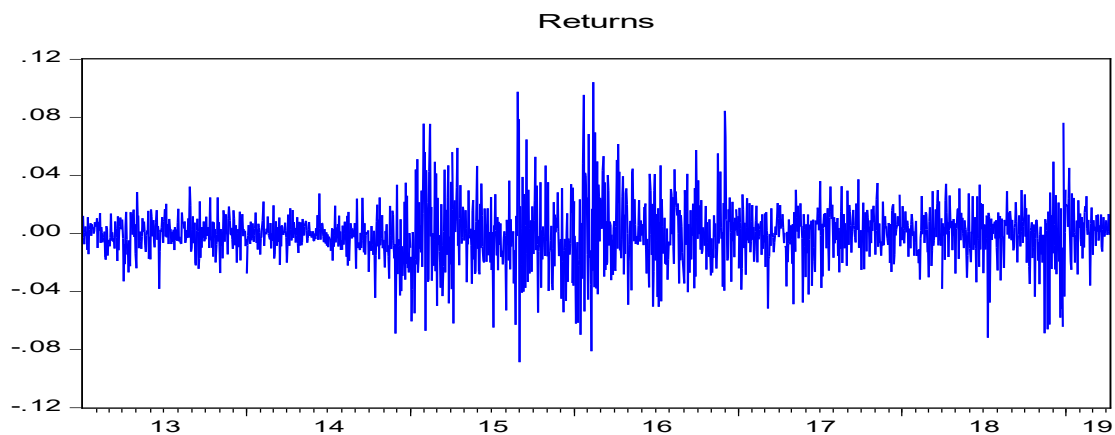
Returns

Source: Authors.

The graph represents the fluctuation of the oil returns during the study period (2013, 2019), it is clear that the differenced natural logarithm of oil prices are characterized by the

high volatility during the period; whereas the most important shocks are happened in the same period (from the mid of 2014 till now)

We have presented above the breakeven price in general and presented its development during the period 2000-2020 for many oil-exporting countries. Since our study focuses on proposing a model for estimating the breakeven price using the Black-Scholes model used in pricing options, we will provide a simple explanation of breakeven price from the perspective of options contracts.

For the option, trading the Break-even point is the market price that an underlying asset must reach for an option buyer to avoid a loss if they exercise the option contract.

4.1 The Break-even price for the call option:

$$BEP_c = C + K \quad (5)$$

Where:

C: is the call option premium

K: is the strike price.

4.2- The Break-even price for the put option:

$$BEP_p = K - P \quad (6)$$

Where:

P: is the put option premium ,

K: is the strike price.

Since Algeria is an oil-exporting country, the appropriate position is to buy the put option contract in order to take the hedging position against the the oil prices dropping.

After presenting the method of calculating the equilibrium price from the perspective of options, we will present the method adopted by the IMF and Middle East Economic Survey as follow:

4.3 Break-even price according to the IMF:

The International Monetary Fund declared that the determinants of the Break-even price are:

- oil productions volume;
- oil exports;
- global oil prices;
- government expenditures;
- National revenue.

Building on that we can get the Break-even price as follow:

$$BEP = [(Gov.Ex - Natianal.\mathrm{Re}venue)/oil.quantityproduced] + per.barrel.\cos t.of.production$$

The main limits of this formula is the lack of the oil prices and the exchange rate.

The formula given by the Middle East Economic Survey taking on account the oil prices written as follow:

$$BEP = \alpha^{-1}(EXP - OFR + yC)/(xQ + yE) \quad (7)$$

Where:

α : is price-differential adjustment factor relative to the value of OPEC basket of crudes.

EXP : is budget an extra-budget expenditure.

OFR : Non-hydrocarbon fiscal revenue.

y : is the average rate of hydrocarbon taxation.

C : Is the hydrocarbon industry's full-cycle cost.

x : Hydrocarbon production-weighted royalty rate.

Q : Marked production of hydrocarbon.

E : Hydrocarbon exports.

The main critic of this formula is the ignoring if the exchange rate. And focusing on the intern approach.

After the brief presentation of the definition of the breakeven oil price; and the most important models proposed for its calculation; in addition to the most important criticism. We will start our study based on the proposed model used in the pricing of options contracts, which allows us through the results to make a comparison with the results obtained by relying on models of international resources.

IV.   Results and discussion:

The first table presents five prices ; according to the results of the Black-Scholes model, which we calculated based on the variables of the model that take into account market prices and prices' volatility; the prices determined by the International Monetary Fund, external breakeven prices and for comparison we used reference prices based on Algeria. In addition to the average oil prices during the study period. While table two highlights the correlation between the prices.

Table 01: The presentation of the different breakeven oil prices types

year	B-S Fiscal Breakeven oil price	Fiscal Breakeven oil prices (IMF)	External Breakeven oil prices	Fiscal Breakeven price In Algeria	Oil prices average
2013	105,059(*)	108,135	108,092	37	108,704
2014	95,423	135,327	115,489	37	99,449
2015	48,587	106,825	96,598	45	53,598
2016	39,684	102,506	89,081	45	45,131
2017	50,548	91,394	90,034	50	54,737
2018	67,226	98,933	101,684	50	71,692
2019	62,253	116,446	106,672	50	64,444

Source: Authors.   (*), is the fiscal breakeven prices based on the B-S's variables; rf: the free-risk rate, S: market oil pieces, K: the Strike price, σ: the volatility. Exp: BEP_{2013}= the average($K_{2013}-P_{2013}$)=105.059.

The second table represents the correlation coefficient between the B-S results and the difference type of breakeven prices.

Table 02: the correlation between the different breakeven oil prices.

Correlations	B-S Fiscal Breakeven oil price	Fiscal Breakeven oil prices (IMF)	External Breakeven oil prices	Fiscal Breakeven price In Algeria
B-S Fiscal Breakeven oil Price	100,00%	56,59%	85,95%	-74,15%
Fiscal Breakeven oil prices (IMF)	56,59%	100,00%	83,02%	-61,73%
External Breakeven oil prices	**85,95%**	83,02%	100,00%	-57,30%
Fiscal Breakeven price In Algeria	-74,15%	-61,73%	-57,30%	100,00%

Source: Authors.

The tables above show the different types of breakeven oil prices and the correlation between these prices respectively. We can explain the high correlation between the Black-Scholes breakeven prices and the external breakeven prices (85.95%) by the convergence of the determinants used to make the calculation; wherein the external breakeven prices taking on account the oil prices which are determined in global markets; while the IMF formula does not take on consideration the external factors such as the oil prices; which explain the weak correlation 56.59% between the Black-Scholes model prices and the IMF breakeven prices. We observe from the result the strong correlation between the IMF breakeven prices and the external breakeven oil prices the explanation of this result can be returned on the calculation of the external prices when the imports can be considered as the analog of the government expenditures and the hydrocarbons revenues as the analog of the fiscal revenues. These two factors among the main important keys to calculate the breakeven prices according to the IMF formula. We can say that the external breakeven prices would not cause external pressure on the public budget or on the currency peg for the countries that are committed to a currency peg and Algeria one of these countries.

The prices we get through the model are very close to the external breakeven prices, which is required. In another word, it should not be a big difference between the breakeven price and the price set in the international markets because this gap will open the door to manipulation of the revenues obtained. Whereas, oil revenues were channeled to the Revenue Control Fund to finance the budget deficit. In Algeria, for example, a reference price has been determined by 37

dollars per barrel, while oil prices have exceeded 100 dollars in some years. Despite all this, Algeria has continued to suffer from a budget deficit due to high import costs, where nearly 75% of the enterprises import raw materials from abroad.

Experts in Algeria in the preparation of the budget estimate the hydrocarbon revenues required to balance the budget on three indicators; the amount of the expected hydrocarbon productions, the reference price of the barrel of oil approved for the preparation of the budget in addition to the exchange rate of the dinar against the dollar.

The exchange rate is among the most important criticisms of the IMF's method of calculating the breakeven price because of its negligence of the impact of the exchange rate on its calculation. Although Algeria takes into account this indicator, the reference price still far from the price determined in global markets.

Estimates of the equilibrium price calculation by the International Monetary Fund may be overpriced because it depends on the volume of exports that are subject to sudden differentiation. State expenditures, which can be altered by political decisions, such as coping with emergency conditions, are also vulnerable to unexpected inflation crises that increase spending.

In the aftermath of the global financial crisis in 2008, the world entered a period of an economic slowdown that led to the emergence of huge problems that have taken root in various countries of the world, including Africa. Algeria is facing the greatest economic challenges since the civil war in the nineties of the last century. Where the repercussions of the global financial crisis showed a creep in the decline in oil prices, which led to the weakening of the local economy. This decline in export revenues translated into a current account deficit. For the first time in more than 15 years; and worsened the situation is the decline in domestic production of energy resources such as oil and gas. Due to the weak institutional base of the Algerian state and its dependence on the rent economy without creating an investment environment. That is saturated to meet the different needs of the state and society; there is a need to support local energy allocations. In addition to promote economic diversification by encouraging the non-oil sector and a more effective management policy of oil wealth on the future of Algeria (Short, medium and long term) This is a challenge and a crisis in itself in the face of the Algerian economy as it depends on more than 75% of oil revenues.

The government has lowered the reference price of a barrel of oil in its preparation of the draft fiscal law for 2020, and adopted the price of $ 45 per barrel instead of $ 50, due to the instability of the oil market and the decline in prices. The government was forced to revise the reference price of the barrel of oil adopted in its estimates in the preparation of the draft financial law for the coming year, but this time the reduction, not the increase, after the last review in 2016, and was included in a tripartite scheme for the preparation of financial laws for the years 2019, 2020 and 2021, as it was the government is likely to raise We talked before about the high volatility of oil prices in the recent period. We will present the first and second figures, which represent the cost of using Algeria to put option contracts as an oil-exporting country where we tested two cases; the first in the case of the breakeven price based on the Black Scholes model is equal to the strike price. The second case is the market price (underlying price)

equal to the strike price. This is based on the proposed model, which enables us to calculate the cost of the contract.
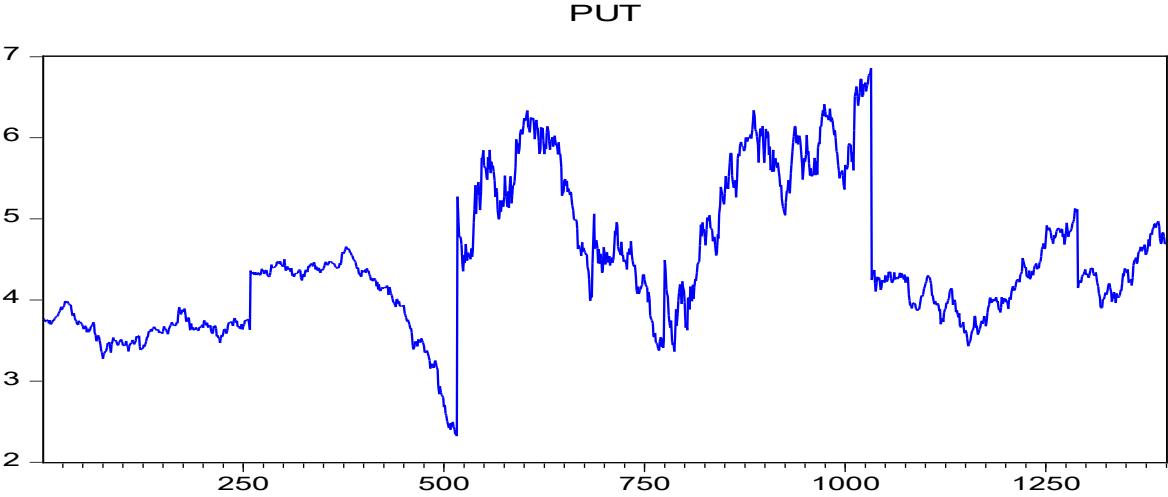
Figure 03: The cost of the put option in the case BEP$_{BS}$ = K

PUT
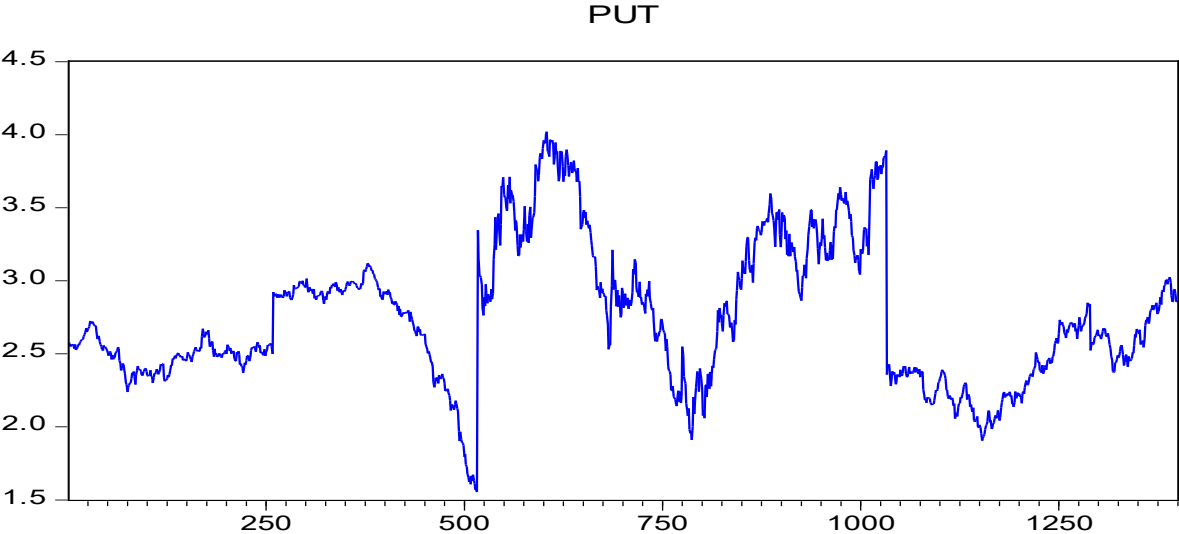
Source: Authors

According to our data; which are used to calculate the option premium based on the Black-Sholes model. Alternatively, the cost the put option we can observe that the average of the cost is 2.68 for the put option contract, in other word we can say that Algeria will pay 2.86$ to take a position of the byer of the put option; when the Fiscal Breakeven oil price is the strike price.

**Figure 02: The cost of the option in the case S=K**

PUT

Source: Authors.

This figure highlights the cost of the put option when the strike price is equal to the underlying price, we can observe that the cost augmented with an average of 4.36$ in comparison by the previous figure (2.68$). That is mean, if the strike price is higher than the market price, the cost of the option increases, which is logical because in the position of buying

a put option, the executive price should be larger than the market price and therefore the cost is higher because it will be an executive option for the contract holder.

The cost estimate allows the contract to hedge against oil price volatility. According to the results obtained from the two figures above, when the strike price is higher that the underlying price the possibility to execute the contract will be higher; which corresponds to the philosophy of the option holder, who expects oil prices to fall below the markets prices, enabling him to achieve unlimited returns Leading to higher option cost. This mechanism can give the government the opportunity to take a hedging position and reducing risk.

Figure 04: The performance of the Fiscal Breakeven price against the market prices
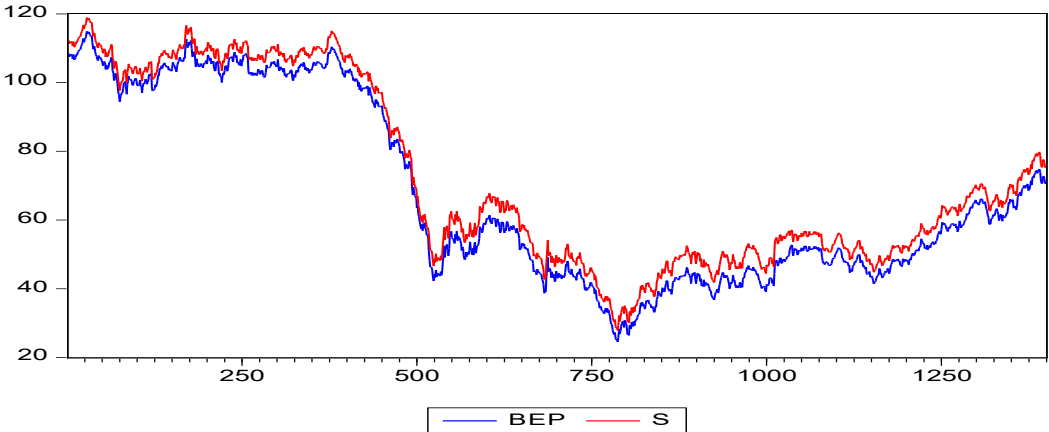
Source: Authors.

This Figure shows the logically relationship between the market prices and the Breakeven prices which should be lower than the markets prices.

V. Conclusion

Fiscal sustainability, or public finance sustainability, is the possibility of the governments to sustain its current spending, tax and other policies in the long term without threatening government solvency or defaulting on some of its liabilities or promised expenditures.

We aimed in our investigation to propose a new approach for calculating the fiscal breakeven oil prices in the oil-exporting countries in general and in Algeria especially. The fiscal breakeven oil prices are now broad and well researched in public finance; as an important tool to achieve financial sustainability, especially for countries that rely heavily on oil revenues, including Algeria (75%). The main result of our paper indicates that the Black-Scholes model is valid to predict the fiscal breakeven prices in Algeria rather than the oil-exporting countries.

This result has proved by the strong correlation between the Black-Scholes prices and the External breakeven prices that is mean the Black Scholes model is more closely related to external prices because it takes on consideration the oil prices as well as the volatility; while it has a small correlation with the IMF prices. Which confirms the main critics for the IMF

formula. Another finding indicates that Algeria can manage its situation against the oil price volatility in markets by taking the position of the holder of the put option; this position allows knowing the cost of each decision taking in order to make the hedging position or the right decision.

Study prospects:

- ✓ Continue researching the topic, taking into account the dynamic variability ;
- ✓ Take into account the exchange rate variable.

Recommendations:

- ✓ The possibility of oil –exporting countries using options contracts as a tool to hedge against the volatility of oil prices;
- ✓ Reforming the economic system by restructuring the financial market in order to keep pace with changes at the global markets.

VI.   References

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