



# Do Oil Prices Govern GDP and Public Spending Avenues in Saudi Arabia? Sensitivity and Trend Analysis

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## ABSTRACT

The oil revenue constitutes 50% of the GDP of Saudi Arabia approximately and indirectly governs the Public spending Avenues (PSA). The study finds out the symmetry in sensitivity and trend of Oil prices (OP), GDP, and Public Spending Avenues (PSA) and the impact of volatility of oil prices on the GDP, and PSA. The analysis is based on the Chain based Index (CBI) and Fixed Based Index (FBI) numbers to get the sensitivity and trend movement of the variables. Coefficient of variations (CV), ANOVA (Analysis of Variance), and correlation computed to get normality, similarity, and the casual relationship of the variables. OP governs the GDP positively and proportionately while there is a negative correlation between the OP variations and the PSA. Saudi Arabian government enhances its spending on PSA and especially on education irrespective of the lowering of OP year by year. OP and GDP do not govern the movement trend of PSA in the long term while shocks of OP and GDP yearly affect the PSA of Saudi Arabia. There is a need to diversify the income resources to minimize the dependency on OP and hedging the budget deficit from the volatility of OP by considering the impact of the sensitivity of OP on the economy and PSA. The policymakers must consider the sensitivity, trend, and governance of GDP and PSA by the OP to formulate the appropriate policies to shift oil economy to non-oil economy to minimize the impact of shocks of OP on the economy.

**Keywords:** Oil Prices, Public Spending, Oil Sector Revenue, Saudi Arabia, Optional Resources

**JEL Classifications:** Q40, Q41, I10, I20, I30

## 1. INTRODUCTION

The prosperity of any nation depends on the optimum utilization of the resources and the growth rate of the economy is accelerated by the appropriate management of the factors of production. The utilization of the resources and their effective management facilitate maximum production of goods and services while monetary returns or consideration of goods and services accounts for the economy. Kingdom of Saudi Arabia owns 17% proven reserves of the world and constitutes 50% of the Saudi GDP, approximately (Saudi Arabia facts and figures, 2020). The GDP of oil-exporting nations directly depends on the exports of the oil products and governs the economy (Dreger and Rahmani, 2016); (Nyangarika, 2018), while indirectly governs public spending. In

oil-exporting countries, negative OP volatility harms the economy and is considered a barrier to the development (Ebrahim et al., 2014) while positive oil price changes refer to the growth of the oil-exporting countries, impliedly. In Saudi Arabia, there was the lowering of OP for two decades and found the oil price governs the economy and its growth positively (Al Rasasi et al., 2019; Alharbi, 2020).

Table 1 explains the movement trend of the OP, and GDP of Saudi Arabia and indicates the negativity in average variations of oil prices (-36.13%) while positivity in GDP (5.53%). This explores the changes of the OP that does not govern the GDP and the growth and contribution of the non-oil sector in the Saudi economy in long run.

Figure 1 explains the similarity in the trend movement of OP, and GDP maintaining a progressive gap between the OP and GDP of Saudi Arabia. This implies that OP shocks affect GDP positively but not perfectly. The GDP of Saudi Arabia enhancing year by year irrespective of partly affects by the OP shocks in long run. In the Saudi context, revenue from oil is considered as a source of economic growth and development (Alodadi and Benhin, 2015). So, there is a need to found the governance relationship of the public spending by the OP and GDP of Saudi Arabia and explore significant differences of sensitivity and trend of OP, GDP, and PSA. In the past two decades, the shocks of OP affect the economy negatively. The public deficit is expected to rise by 92.8% of GDP by 2030 (Soummame et al., 2019) in Saudi Arabia. To achieve the goals of vision 2030, the Saudi government will have to consider the development of the private and non-oil sector to scale the predetermined rate of growth and development of the economy. In the last few years, the OP decrease internationally and affect the GDP of Saudi Arabia as the oil sector revenue is constituted half of the GDP, approximately. The public spending of the government enhance the living standard of the citizens and assures the level of contribution towards the nation. As the OP decrease, it will affect the GDP and ultimately PSA. There is a need to get the comparative sensitivity and trend of the OP, GDP, and PSA and consider the under and over-allocation of the funds towards the PSA and identify the alternative sources of income to hedge the economy from the shocks of OP.

## 2. LITERATURE REVIEW

Abdel-Latif et al. (2018) studied OP shocks on health and education and found a curvilinear relationship. The negative deviations in the OP significantly and positively correlated with government spending compared to positive deviations. Bodea et al. (2016) explained the effect of the OP on the PSA is the matter of expenditures allocated to the military and other government

services. They found a high degree association between the spending on military, and oil and gas resources of the nation and suggested to priorities on public services instead of spending on the military. Algahtani (2016) investigated the effect of shocks of OP on Saudi economic activity and found a positive and significant relationship between OP and the economy of Saudi Arabia in long run. Elmezouar (2020) investigated the relationship between the real OP and real GDP of Saudi Arabia and indicated and projected the causality between the OP and GDP of Saudi Arabia and invited policymakers to consider the OP sensitivity on the economy in policymaking. Moshashai et al. (2020) considered the diversification of resources to minimize the budget deficit and dependency on the oil sector by forming the appropriate budgets and policies to achieve the goals of vision 2030. Maghrebi et al. (2018) found the cointegration between the OP and the GDP of Saudi Arabia.

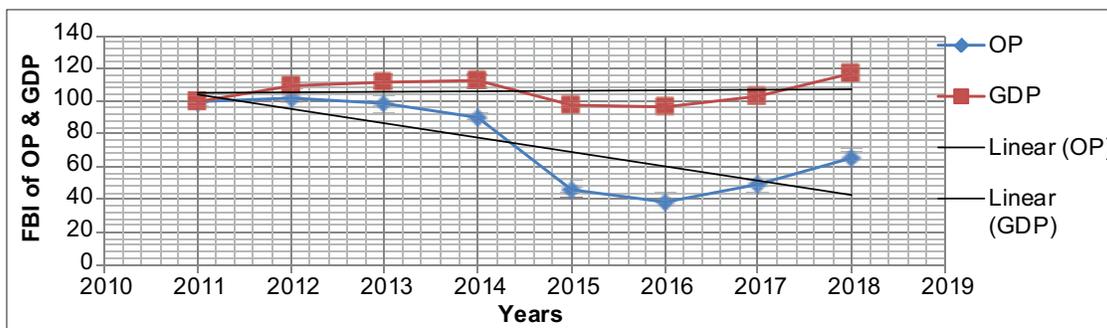
Al-Maamary et al. (2017) studied the impact of OP fluctuations on the common renewable energies in GCC countries and found that renewable energy i.e. solar, wind sources, nuclear power, and hydrogen fuel cell sources may be an option in the future. Nasir et al. (2019) analyzed the shocks of OP on the macro economy of GCC and found positive effects on GDP. They suggested the diversification of the economy to mitigate the negativity of the OP shocks on the economy. Jawadi and Ftiti (2019) studied the OP changes and their impact on the Saudi economy and found the asymmetric and non-linear relationship between the OP and GDP of Saudi Arabia and suggested economic diversification. Foudeh (2017) found a strong positive and linear impact of OP on the GDP of Saudi Arabia. Ghalayini (2011) studied the changes in the world economic growth due to changes in OP. Increase of OP negatively affects the oil importing economies while positively affects the oil exporter countries. Zubair et al. (2019) found the high dependency on oil resources is the problem of Saudi Arabia and indicated available solar energy resources to diversify the economy. Haque (2019) explained that Saudi Arabia is an energy

**Table 1: Growth trend of oil price, oil sector Revenues, and GDP of Saudi Arabia**

Years	2011	2012	2013	2014	2015	2016	2017	2018	Average variations from 2011(%)
Oil price	107.46	109.45	105.87	96.29	49.49	40.76	52.43	69.78	-36.13
FBI	100	101.85	98.52	89.61	46.05	37.93	48.79	64.94	
GDP	2517146	2759906	2799927	2836314	2453512	2418508	2582198	2949457	5.53
FBI	100	109.64	111.23	112.68	97.47	96.08	102.58	117.17	

Source: National account statistics and oil statistics (Annual statistics 2019) available at <http://www.sama.gov.sa/en-US/EconomicReports/Pages/YearlyStatistics.aspx>. GDP at produces values at current price in Million SR. Oil price is nominal oil price in USD per Barrel

**Figure 1: Growth trend of Oil prices and GDP of Saudi Arabia**



Source: Based on FBI of oil prices and GDP given in Table 1

prosperous country depending on the expatriate human effort. He found the extreme polar contribution of the labor force and investments in the predominant oil sector in the Saudi economy and suggested the diversification of productive sectors and minimize the unproductive expenditure on education.

Aloui et al. (2018) studied the relationship between OP, exchange rate, and output growth rate in the Saudi economy. They found the Saudi economy faces the oil market volatility at the international level that affects the economy negatively. Alam (2020) studied the relationship between the money supply and stock market and found positivity while negativity between the inflation, short-term interest rate, and crude OP. He suggested the diversification of the economy and indicated tourism and manufacturing. Also, Su et al. (2019) suggested the diversification of resource income to minimize the reliability of OP. Algaeed (2018) studied the non-linear effects of the OP on the Saudi import and found that the OP shocks negatively affect the real aggregate import demand. Abid and Alotaibi (2020) explored the significant and positive impact of OP changes on the Saudi Arabian private investment. They suggested develop the natural and other resources by the Saudi government and finance ministry needs to develop economic transformation policy shifting from the oil to the non-oil sector. Ashfaq et al. (2019) analyzed the impact of OP shocks on oil-exporting and oil-importing countries and found a significant correlation on the oil-exporting countries more than the importing countries.

Bergholt et al. (2019) explained that the recent OP shocks attracted policymakers to hedge the economy against the OP shocks. They found that OP shocks represent the macroeconomic volatility in Norway and stated that the impact of the two shocks is not equal. The domestic oil industry supply chain is an important mean of price movements. Baumeister and Kilian (2016) studied lowering the OP and its impact on the U.S. economy and found that a very slow response of OP changes on the economy and there is no negative impact of oil-related investment on non-oil related investment. Nyangarika et al. (2019) explored the impact of the OP shocks on the Russian economy. They found the world price of oil is the main consideration while found the positive relationship between the OP and the Russian GDP. They suggested the low dependence on the energy resources and diversification of the economy by attracting foreign investments. Mohaddes and Pesaran (2017) stated that the recent lowering prices of the oil are good for the US and global economy. They found a stable negative relationship between OP and real dividends. The low price negatively affects the oil-producing economies and forces to enhance oil production to compensate for the loss of low OP.

### 3. RESEARCH METHODOLOGY

The study is based on the data taken from the website of the Saudi Arabian Monetary Authority (SAMA) for the period 2011 to 2018. Oil Prices (OP) are considered as independent while GDP, Public Spending Avenues (PSA) considered as dependent variables to analyze cause and effect relationship, sensitivity, and trend analysis. The Coefficient of Variations (CV) applied to get

the normality of the variability of all variables under consideration for this study (Ali, 2020b).

$$CV = \frac{SD}{Mean}$$

Where SD is the Standard deviation and Mean is the average of the distribution. Karl Pearson's coefficient of correlation is calculated to assure the cause and effect relationship among the OP, GDP, and PSA.

$$\text{Karl Pearson's correlation coefficient} = r(x, y) = \frac{COV(x, y)}{\sigma_x \cdot \sigma_y}$$

Where,  $COV(x, y)$  is the covariance between  $x$  and  $y$ ,  $\sigma_x$  and  $\sigma_y$  is the standard deviation of  $x$  and  $y$  variables. Chain Based Index Numbers (CBI) and Fixed Based Index Numbers (FBI) of all variables and correlation coefficient between the CBI of OP, and dependent variables calculated to get the sensitivity impact of the variability of OP on the other dependent variables. Also, the correlation coefficient between the FBI of OP, and dependent variables calculated to get the long term impact of the variability of OP on the other dependent variables (Ali, 2020a).

$$CBI = \frac{\text{Value in the current year}}{\text{Value in the previous year}} \cdot 100$$

$$FBI = \frac{\text{Value in the current year}}{\text{Value in the base year}} \cdot 100$$

Note: Year 2011 taken as base year for the FBI calculation.

To know the significant difference among the trend and sensitivity of OP, GDP, and the PSA, Fisher's ratio (F) is calculated and compared with the critical value ( $F_{\infty}$ ) (Ali, 2020a).

$$F = \frac{B_{ss} / df_1}{W_{ss} / df_2}; \text{ While, } F \geq F_{\infty}, \text{ Reject } H_0;$$

Where, F is Fisher's ratio, and  $B_{ss}$ ,  $W_{ss}$ ,  $df_1$ ,  $df_2$ , are sum of squares between samples, sum of squares within samples, degree of freedom 1 and degree of freedom 2, respectively. The  $df_1$ ,  $df_2$  obtained as follows:

$$df_1 = K - 1, \text{ and } df_2 = N - K;$$

Where, K = Number of Samples, and N = Number of all variables.

Research Hypothesis

$H_{01}$ : There is no significant difference between the variability of OP, GDP, and PSA in Saudi Arabia

$H_{02}$ : There is no cause and effect relationship among the OP, GDP, and PSA

$H_{03}$ : There is no significant difference between the trend of OP, GDP, and the PSA

$H_{04}$ : There is no significant difference between the sensitivity of OP, GDP, and the PSA.

## 4. DATA ANALYSIS AND RESULTS

To get the objective of the study, the analysis of the OP, GDP, and PSA of Saudi Arabia can be divided among three categories i.e. Normality of variables, cause and effect relationship, and similarity of sensitivity and trend of OP, GDP, and PSA.

### 4.1. Normality of Variables

The normality of variables explains that the variables are not affected by the abnormal factors or the fluctuations or deviations in the series are insignificant. The assurance of normality of the variables makes data comparable, mutually.

From Table 2 it is obvious that the variations in the OP, GDP, and PSA are normal and gradual, not driven by any abnormal factor. The variability of OP is higher than the other variables from 2011 to 2018, comparatively. Overall, the variability of all variables is not affected by any abnormal factor. Hence,  $H_{01}$  is accepted. So, there is comparability among OP, GDP, and PSA of Saudi Arabia.

### 4.2. Cause and Effect Relationship

The cause and effect relationship explains the effect of changes in the dependent variables on the other independent variables. A high degree correlation between the OP and GDP and PSA explains the high impact of changes in oil prices on the GDP and public spending in Saudi Arabia while a low degree or no correlation reflects the negligible or no impact of price volatility on the GDP and PSA.

Table 3 explains that OP affects GDP positively and moderately ( $r = -0.51$ ) while negatively to PSA in long run. This refers that the OP positively and proportionately governs the GDP as the oil sector revenue constitutes 50% of the GDP. The negative governance of the OP varies avenues to avenues of public spending. Education expenditure of the Saudi Arabia government is only highly and negatively governed by the OP while other avenues of government are spending negatively but negligibly. So, there is a cause and effect relationship among the OP, GDP, and PSA. Hence,  $H_{02}$  is rejected. The GDP of Saudi Arabia positively contributes to all the PSA but not proportionately according its growth while the prices of oil decrease. This implies that either the Saudi government enhances its oil export or shift from the oil source of income to other sources and contributes to PSA irrespective of downfall in the OP as the oil largely contributes to the Saudi GDP.

### 4.3. Similarity of Trend and Sensitivity of Oil Prices, GDP, and Public Spending

The trend reflects the long term co-movement of the variables while sensitivity explains the short term variation of the variables. The similarity of trend and sensitivity of OP, GDP, and PSA of Saudi Arabia explores the long term and short term variability.

Table 4 indicates that OP, GDP, and PSA movement in long term are significantly different while no significant differences in the sensitivity of all variables. This implies that the OP and GDP do not govern the movement trend of PSA in the long term while shocks of OP and GDP yearly affect the PSA of Saudi Arabia.

**Table 2: Variability of oil prices, GDP, and public spending avenues in Saudi Arabia**

Years	Oil prices	GDP	Public spending avenues				
			Education	Health	Hous. and Commu. Amen. Ser.	Soc. Secu. and Welf.	Oth. Commu. and Soc. Ser.
2011	107.46	2517146	141859	62663	24662	2039	9317
2012	109.45	2759906	159235	75752	26075	3210	10950
2013	105.87	2799927	186605	94479	39620	4300	12711
2014	96.29	2836314	199370	105826	42531	5221	15551
2015	49.49	2453512	211716	101059	38093	4216	14722
2016	40.76	2418508	189416	81573	30219	3022	11144
2017	52.43	2582198	193419	81512	30643	3240	11923
2018	69.78	2949457	222585	93971	34737	4203	14367
Mean	78.94	2664621	188025.6	87104.38	33322.5	3681.38	12585.63
SD	28.99	197005.3	26396.91	14317.29	6475.84	989.97	2152.18
CV	0.37	0.07	0.14	0.16	0.19	0.27	0.17

Source: Own calculations based on data of National account statistics and Oil statistics (Annual statistics 2019) available at <http://www.sama.gov.sa/en-US/EconomicReports/Pages/YearlyStatistics.aspx>

**Table 3: Cause and effect relationship among oil prices, GDP, and public spending in Saudi Arabia (2011-2018)**

OP, GDP, and PSA	Oil prices	GDP	Education	Health	Hous. and Commu. Amen. Ser.	Soc. Secu. and Welf.	Oth. Commu. and Soc. Ser.
Oil prices	1.00						
GDP	0.51	1.00					
Education	-0.61	0.27	1.00				
Health	-0.22	0.38	0.83	1.00			
Hous. and Commu. Amen. Ser.	-0.08	0.38	0.71	0.96	1.00		
Soc. Secu. and Welf.	-0.01	0.57	0.73	0.97	0.94	1.00	
Oth. Commu. and Soc. Ser.	-0.22	0.44	0.85	0.97	0.89	0.95	1.00

Source: Own calculations based on data of National account statistics and oil statistics (Annual statistics 2019) available at <http://www.sama.gov.sa/en-US/EconomicReports/Pages/YearlyStatistics.aspx>

**Table 4: Similarity among the oil prices, GDP, and PSA Saudi Arabia (2011-2018)**

H <sub>0</sub> No.	Hypothesis	F*	F $\alpha$ **	Decision: H <sub>0</sub> (If F $\geq$ F $\alpha$ , Reject H <sub>0</sub> )
H <sub>03</sub>	There is no significant difference among the trend of oil prices, GDP, and the public spending.	6.153932	2.437693	Reject H <sub>0</sub>
H <sub>04</sub>	There is no significant difference among the sensitivity of oil prices, GDP, and the public spending	0.437275	2.437693	Don't reject H <sub>0</sub>

Source: \*F values (ANOVA) calculated based on the FBI (H<sub>03</sub>) and CBI (H<sub>04</sub>) of OP, GDP, and PSA and \*\*F taken from the F-table. F $\infty$ \*\* taken from the F-table at 5% significance level. F\* values are the Fisher's ratios values and calculated using EXCEL's calculation. FBI and CBI calculated based on values given in Table 2

## 5. CONCLUSION AND IMPLICATIONS

In Saudi Arabia, OP govern the GDP positively and proportionately while all the public spending negatively (Maghrebi et al., 2018; Algahtani, 2016). The positivity and negativity of oil prices can be seen in the economy of oil-exporting countries (Alsamara et al., 2017; Ghalayini, 2011). Education public spending avenue is highly and negatively governed while another public spending negatively and negligibly governed by the oil prices (Abdel-Latif et al., 2018). This implies that the Saudi Arabian government is much concerned about the spending on PSA especially on education, and moderately on another public spending irrespective of lowering of oil prices. The movement trend of all the variables i.e. OP, GDP, and PSA is significantly different while sensitivity is similar to all the variables. It reveals the oil price shocks do not affect the GDP and public spending in long run but governs the GDP and public spending in the short run in Saudi Arabia. The conventional source cannot be considered suitable for economic growth in the long run. In Saudi Arabia, opportunities can be explored in the field of renewable energy and innovative technologies by the research initiatives of the experts and scientists from the advanced countries (Tlili, 2015). So, there is a need to shift the oil-based economy to a knowledge based economy by considering education, employment, innovation, information, and communications technology (ICT), human capital, and economy in Saudi Arabia (Nurunnabi, 2017).

To maintain the optimum balance among the PSA in Saudi Arabia, spending on education can be reduced by minimizing the spending on unproductive education (Haque, 2019). In Saudi Arabia, there is a need to consider the sensitivity of oil prices on the economy by the policymakers to formulate the appropriate policies to minimize the impact of shocks of oil prices on the economy (Elmezzouar, 2020; Nonejad, 2020). The appropriate policies towards the shifting from oil economy to non-oil economy are the shield to face and save the economy from the negative impact of the oil price volatility (Van Eyden et al., 2019) in Saudi Arabia.

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