

# **Influence of OPEC on World Oil Prices**

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## Abstract

*OPEC (Organisation of the Petroleum Exporting Countries) is believed to have an influential role in the world's oil prices. Many researchers have tried to develop models and tested theories on the role of OPEC in manipulating oil prices. Our paper aims to highlight the trends from 1960 to 2020 in the oil prices of major oil-producing OPEC and non-OPEC countries. The OPEC countries covered for the research are Saudi Arabia, Iraq, UAE, Iran, Kuwait, and Nigeria; and non-OPEC countries include the US, Russia, Canada, China, Brazil, and Kazakhstan. Testing for the hypothesis of whether OPEC influences the oil prices or the idea of OPEC as a cartel is a 'rational myth' has been underlined in the paper. The two major world oil crises of 1973 and 1979 and the extent to which OPEC was responsible for causing them have also been discussed through various statistical tools. Tools like regression and correlation have been used for the research. The role of Saudi Arabia has been meticulously analysed in the production of oil, its policies and price manipulation, and its position in OPEC.*

## **1. INTRODUCTION**

Organization of the Petroleum Exporting Countries (OPEC) is an intergovernmental organization formed initially by five countries Iran, Iraq, Saudi Arabia, and Venezuela. Founded on September 14, 1960 in Baghdad, the organization has been headquartered in Vienna, Austria since 1965. Since its formation, OPEC has been considered to have a strong foothold in the Oil Market and is believed to have an influence on it.

Currently, OPEC has 13 member nations namely, Algeria, Angola, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, the Republic of Congo, Saudi Arabia, the United Arab Emirates and Venezuela. OPEC's former members include Ecuador, Indonesia, Qatar. OPEC produces about 40% of the world's crude oil. According to 2018 data, OPEC'S proven world oil reserves account for 79.4% of the total world oil reserves (a total of 1189.80 billion barrels at the end of 2018).

OPEC was formed with a mission ‘to coordinate and unify the petroleum policies of its member countries and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers and a fair return on capital for those investing in the petroleum industry’. Many economists and researchers categorise OPEC as a cartel.

In 1970s, OPEC gained an international prominence as its member nations took over the control of their domestic petroleum industries and had begun to play a greater role in the world oil markets including the Oil Shocks of 1973 and 1979. In 1980s, demand for energy slumped and the oil demand fell in the early part of the decade leading to a market crash in 1986. OPEC’S share in the market declined and its revenue dropped causing economic instability in many member countries. However, oil market began to reconcile and so did OPEC’s share in the later part of decade. Timely action of OPEC in 1990’s reduced the market impact of Middle East issues in 1990-91, but excessive volatility dominated the decade.

In 2000s, OPEC continued with its efforts to help strengthen and stabilize the global oil market in the early years of the decade. But gradually the market volatility continued to increase in an unprecedented manner in early 2008, before the collapse of the global financial sector that led to economic recession. OPEC became prominent in supporting the oil sector. In 2010s, the global economy represented the main risk to the oil market early in the decade, as global macroeconomic uncertainties and heightened risks surrounding the international financial system weighed on economies. The oil market remained stable from 2011 until mid-2014 when a combination

of speculation and oversupply caused it to contract. Trade patterns continued shifting, as global oil demand grew, particularly in Asian region. OPEC helped in stabilizing global oil market.

In 2020s, the new decade witnessed an unprecedented beginning with the outbreak of the COVID-19 pandemic having a detrimental impact on both the world economy and the energy sector. Thus, this decade saw the growing importance of OPEC in world oil market, and hence the topic remains of greatest importance.

## **2. THEORETICAL FRAMEWORK**

A great amount of research has been done on *OPEC (Organisation of Petrol Exporting Countries)* and it's working by scholars globally. OPEC has created an image as the market manipulator for itself in the world crude oil market in all these years. Crude oil being one of the most important commodities all over the globe has helped OPEC to represent itself as a really powerful organisation manipulating the world crude oil prices. Researchers have tried to analyse the control of OPEC in the oil markets, checking if the image of a prominent market player, OPEC, has made for itself is really true. Various complex models and indices have been used by researchers to check the market power of OPEC. But there is no conclusive evidence available showing OPEC has a significant impact on world crude oil prices. By means of this research paper, we have tried to highlight the inefficiency of OPEC as a cartel and lack of coordination among OPEC countries. Due to unavailability of the data on country wise supply of crude oil, it was not possible to directly relate it with the crude oil prices in world market. We have used a simplified approach to show OPEC's hold on the

oil market by using the data on production, reserves and prices of crude oil. We have focussed on the world oil crisis of the 1970s and the role of Saudi Arabia within OPEC and how it has always been a prominent market player which has helped OPEC to create the false image of being a market manipulator.

### **3. OBJECTIVES**

1. To study the cohesiveness of OPEC as a cartel.
2. To study the Oil Shocks of 1973 and 1979.
3. To study the influence of Saudi Arabia and how its role has changed in OPEC.

### **4. LITERATURE REVIEW**

Organization of Petroleum Exporting Countries (OPEC) has been believed to have a strategic position in the world oil market having significant role in history's note-worthy events. Since oil is the world's most important commodity and changes in its price are commonly believed to have powerful economic and political consequences, numerous studies have been conducted to examine OPEC's ability to influence oil prices. Oil markets have experienced many crises and big shocks in the past (such as low supply of 1970s, the oil glut of 1980s, financial crisis in East Asia in 1998). A plethora of studies have examined these issues along with OPEC production behaviour and the price formation process in oil markets. There are divergent views regarding its pricing power. More importantly, there seem to be switches in perceptions shifting from one end where OPEC is perceived to play no role or a very limited role to the other where it is perceived to be a price-setter.

Using the connectedness measure, it is found out that the network structure among the major oil producing countries changes over time. Specifically, the impact of OPEC on all oil-producing countries declines whereas that of non-OPEC on all countries increases. The total coordination of OPEC members decreases substantially after 2012 (**Sahel et al. 2018**). From the discovery of oil in the Middle East at the beginning of the twentieth century until the early 1970s, OPEC member countries played no role in the production or pricing of crude oil. The oil market was dominated by the large multinational oil companies known as the Seven Sisters. *“Between 1970 and 1973, global demand for oil increased at a fast rate with most of the increase in demand met by OPEC countries. In December 1973, OPEC raised the posted price of the Arab light to \$11.651. These events represented a dramatic change in the pricing system. For the first time in its history, OPEC assumed a unilateral role in setting posted prices while previously it had only been able to prevent oil companies from reducing them (Skeet, 1988)”* (**Bassam 2007**). The econometric approach to identify the relationship between market power measures of the Lerner Index (LI) and the Residual Supply Index (RSI) to estimate price elasticity of demand for crude oil tells us about the exercise of market power by OPEC and major oil producers. In this approach, OPEC is the central player and acts as a dominant producer in the global oil market (**Talat 2017**).

Popular wisdom holds that OPEC is influential, but economic studies investigating OPEC’s market impact have had difficulty finding conclusive evidence showing the influence of OPEC on the global oil market as a Cartel. *“The idea of OPEC as a cartel is a rational myth that supports the organization’s true principal function, which is to generate political*



*benefits for its members*”. The oil crisis of 1973 is a major contributing factor to people’s belief that OPEC is a cartel. Those events were perhaps the only series of events during which OPEC did have a significant impact on the world oil market. Yet OPEC’s role in the crisis has been greatly misunderstood. Perhaps the biggest impact of the oil embargo against the United States and others as part of the 1973 Arab-Israeli War by some OPEC members (Arab) was psychological. The embargo solidified OPEC’s image as a cartel and exacerbated fears that the world was running out of oil. Irregularly applied OPEC quotas and overproduction in excess to them by OPEC countries shows its weakness as a cartel. Still, many scholars and policy-makers continue to believe that OPEC has great power over oil markets (**Jeff 2014**). OPEC producers, other than Saudi Arabia, had been persistently producing in excess of their quotas before 1985 but Saudi Arabia was compensating the overproduction by producing less than its own quota following the ‘swing-producer’ strategy. This helped to protect OPEC’s reputation as a cartel but did not penalize cheating by other OPEC countries. After 1985, Saudi Arabia changed its strategy by becoming a ‘Tit-for-Tat’ producer, punishing the defaulters by producing in excess to its own quota. Empirical evidence shows Saudi Arabia has significant market power and it is Saudi Arabia, in particular and not OPEC that manipulates the world oil supply and prices. OPEC’s perceived market power is a useful fiction that generates political benefits for its members with domestic and international audience (**James 1992**).

## 5. METHODOLOGY

### Sample Size and Data Collection

For this research, the data on production of crude oil, reserves of crude oil and world oil prices has been collected from various trusted websites which are mentioned in the references.

For the first objective that is *to study the impact of OPEC on world oil prices*, the sample size is taken as 12. The dataset contains 6 OPEC countries (Saudi Arabia, Iraq, UAE, Iran, Kuwait and Nigeria) and 6 Non-OPEC countries (US, Russia, Canada, China, Brazil and Kazakhstan). Time Period for the study is 60 years, i.e., from 1961 to 2020.

For the third objective that is *to study the influence of Saudi Arabia and how its role has changed in OPEC*, the time period is 20 years, i.e., from 2001 to 2021.

### Research Methods

In this study, Descriptive as well as Inferential Analysis have been used. For the descriptive analysis, tables and various graphs and charts like line graphs, bar graphs and scatter plots have been used which aims to depict and describe the data collected from various sources.

The Inferential Analysis has been done using Statistical tools like Correlation and Regression. For the first objective that is *to study the impact of OPEC on world oil prices*, correlation has been used to show the relation between Production and Reserves by OPEC and Non-OPEC countries. For the second objective that is *to study the oil shocks of 1973 and 1979*, a theoretical analysis has been done. For the third & final objective of the paper, a p-value test has been done using regression.

## 6. FINDINGS

### OBJECTIVE 1

#### TO STUDY THE COHESIVENESS OF OPEC AS A CARTEL

To check the cohesiveness of OPEC as a Cartel, regression analysis is performed on average production of crude oil and average reserves of 6 selected OPEC countries (Saudi Arabia, Iraq, UAE, Iran, Kuwait and Nigeria) from 1961 to 2020.

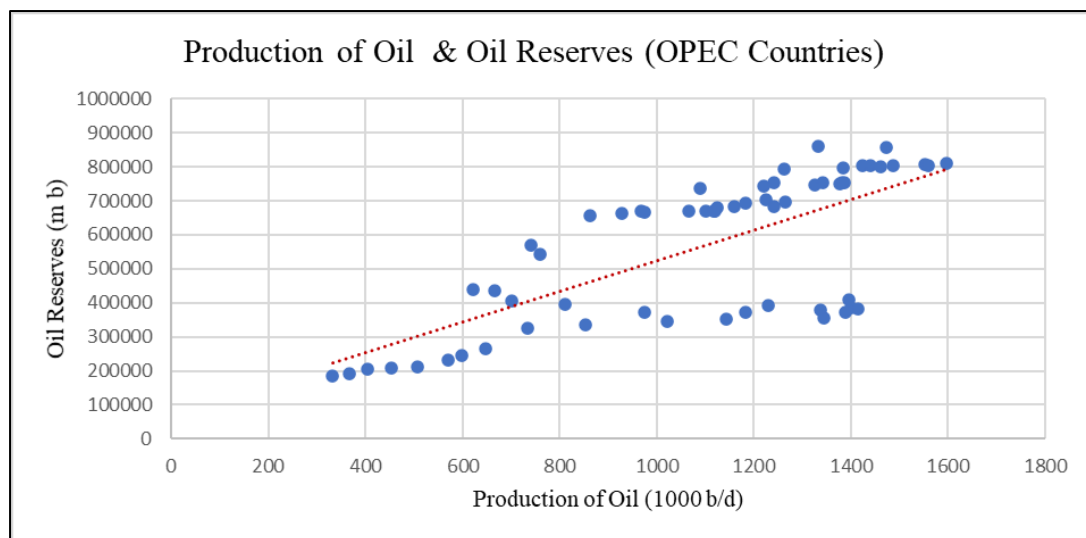
SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0.71362166								
R Square	0.509255873								
Adjusted R Square	0.500794768								
Standard Error	151062.7055								
Observations	60								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	1	1373483500130.75	1373483500130.75	60.19	0.00				
Residual	58	1323556577503.85	22819940991.45						
Total	59	2697040077634.60							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	71822.57974	66117.2996	1.086290278	0.281844749	-60525.57487	204170.7	-60525.6	204170.7	
OPEC(Avg Prod)	450.5967405	58.08093258	7.758083771	1.55941E-10	334.3351222	566.8584	334.3351	566.8584	

The R Square value comes out to be 0.5092 which means OPEC production do not perform a great job of accounting for variation in OPEC's reserves. Only 50.92% of the changes in OPEC's reserves can be explained by changes in OPEC's production levels.

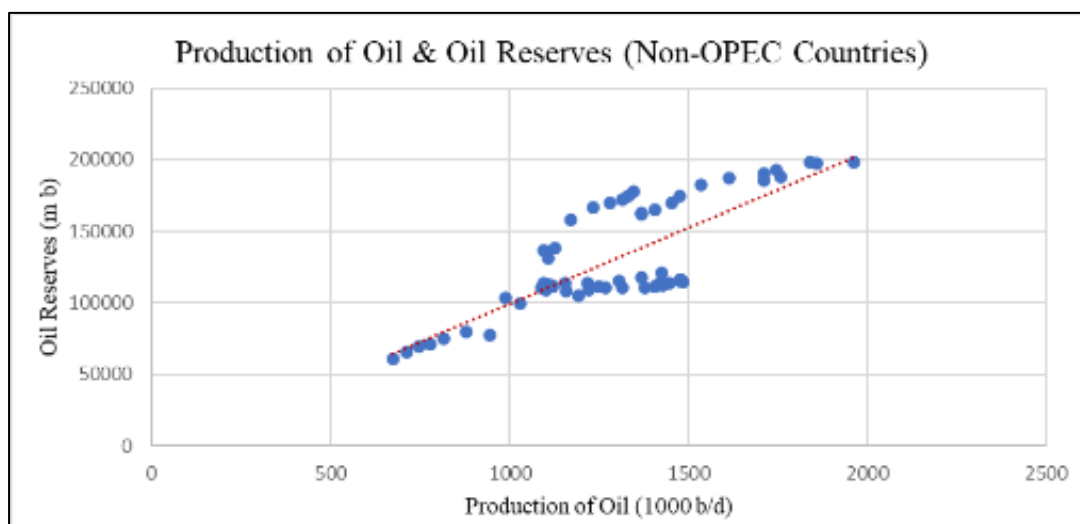
A similar analysis is performed on average production of crude oil and average reserves of 6 selected Non-OPEC countries (US, Russia, Canada, China, Brazil and Kazakhstan) from 1961 to 2020.

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.792664577					
R Square	0.628317131					
Adjusted R Square	0.621908806					
Standard Error	23367.94383					
Observations	60					
ANOVA						
	df	SS	MS	F	Significance F	
Regression	1	53539628121	53539628121	98.04700915	4.4677E-14	
Residual	58	31671526323	546060798.7			
Total	59	85211154444				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-7117.161811	14244.7583	-0.499633736	0.619223181	-35631.14357	21396.82
Non-OPEC(Avg Prod)	106.2873359	10.7340681	9.901868972	4.4677E-14	84.80076409	127.7739

Here the R Square value comes out to be 0.6283 which is higher than that of OPEC's. This indicates that 62.83% of changes in the reserves of Non-OPEC producers can be explained by changes in Non-OPEC producers' production levels.



*Fig.: Scatterplot diagram showing correlation between the production and reserves of OPEC countries*



*Fig.: Scatterplot diagram showing correlation between the production and reserves of Non-OPEC oil producing countries*

Another way of checking the cohesiveness of looking at the deviation in production by OPEC countries from the quotas allotted to them.

<b>Table 2: Mean Percentage Deviation from Quota, 1982-2001</b>			
	<b>4/82 – 3/91</b>	<b>4/91 – 12/01 Excl. outliers</b>	<b>Overall Excl. outliers</b>
Algeria	-2.79	3.52	0.66
Indonesia	-1.62	1.41	0.00
Iran	3.35	2.48	2.81
Iraq	16.08	N/A	N/A
Kuwait	21.12	0.41	7.41
Libya	11.51	2.54	6.18
Nigeria	7.25	4.61	5.65
Qatar	10.71	14.29	12.95
Saudi Arabia	1.75	2.95	2.52
UAE	37.59	1.11	12.16
Venezuela	7.14	10.70	9.37
Sources: EIA, OPEC			

*Source: “A statistical analysis of OPEC quota violations” by Pavel Molchanov*

The table given above shows the mean percentage deviation of OPEC producers from their Quota

By looking at these two analyses, we can safely say that OPEC countries do not act like a Cartel generally. There is no conclusive evidence to show the cohesiveness of OPEC as a Cartel

## OBJECTIVE 2

### TO STUDY THE OIL SHOCKS OF 1973 AND 1979

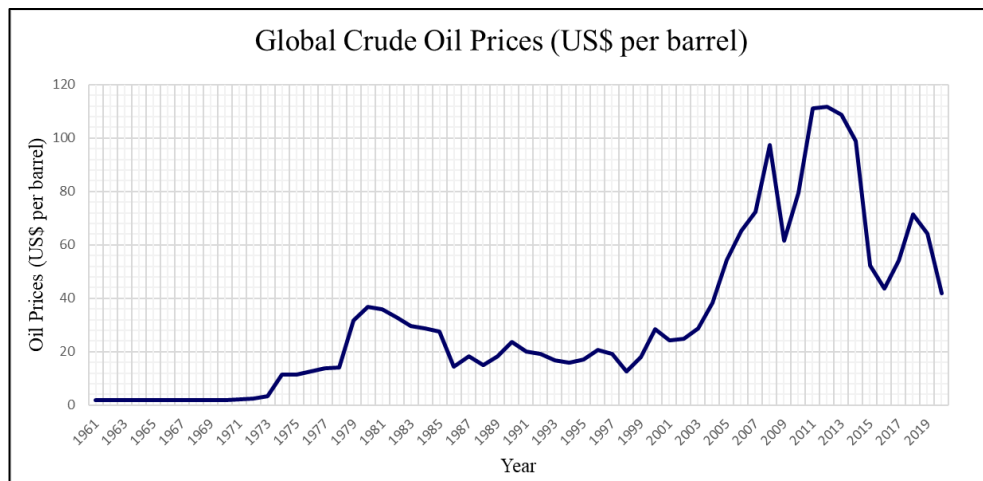
The oil crisis of 1973 began when the members of Organisation of Arab Petroleum Exporting Countries (OAPEC) led by Saudi Arabia declared an oil embargo targeting the nations that had supported Israel during the Yom Kippur War. This led to significant rise in the price from around US \$3 per barrel to nearly US \$12 per barrel globally by the end of 1974. The embargo caused an oil shock with many short-term and long-term effects on world politics and economy.

The collapse of Bretton Woods and the end of fixed price of gold in 1971 changed the situation substantially. As OPEC quickly learned, the currency or commodity in which the oil price of oil was quoted did matter now (Hammes and Wills, 2005). In response to the more rapid than expected fall in the value of the dollar after August 15, 1971, the Teheran Agreement of 1971 was amended in January 1972. The new agreement called for an 8.49% increase in the posted price of oil, “which corresponded to the rise [of 8.57%] in the price of gold vis-à-vis the US dollar” (Ahrari 1986, 62; see also Seymour 1981, 96) (Hammes and Wills, 2005). At that same meeting, it was decided that “in future, postings were to be adjusted upwards or downwards on a quarterly basis in line with an index based on

the movement of the currencies of nine major industrialized countries (Britain, France, West Germany, Italy, Japan, Belgium, Holland, Sweden and Switzerland) vis-à-vis the US dollar” (Ahrari 1986, 62; see also Seymour 1981, 96) (Hammes and Wills, 2005). This automatic indexing was “abandoned altogether in the aftermath of the October 1973 price upheaval and has never been revived since” (Ahra 1986, 87). After two years of the floating dollar, OPEC was acutely aware of the diminishing value of oil in terms of gold. On January 1, 1974, OPEC raised the U.S. dollar price of oil from \$4.31 to \$10.11, producing the first dramatic price shock. After this increase, the “gold price” of oil (at 12.8 barrels per ounce of gold) was back within its historical range. For the rest of the decade, including the second dramatic price rise in 1979, the gold price of oil stayed within its historical range. At the end of the decade, 14 barrels of oil exchanged for an ounce of gold, well within its historical range but with a “real” price approximately 25 percent lower than at the beginning of the decade (Hammel and Wills, 2005).

November 1978 saw the beginning of the oil shock of 1978 when around 37000 workers of Iran’s nationalised oil refineries went on a strike, reducing the production from around 6 million barrels per day to about 1.5 million barrels per day. This led to rise in the oil prices and hence which benefitted a few members of OPEC having huge profits. Under the new Iranian Government, the exports of oil resumed but production remained inconsistent and at a lower volume, further raising the prices. By early 1979, the overall loss in worldwide production was around 4%. In 1980, the war between Iran and Iraq further worsened the situation leading to around 7% drop in the worldwide production. Gradually, OPEC production was surpassed by other oil exporting countries like US due to internal

divides of its member nations. Saudi Arabia, being the ‘swing producer’, tried to gain the control of market after 1985 by increasing production and causing a downward pressure on the price making high-cost oil production facilities less profitable.



*Fig.: Graph shows a sudden increase in the prices of oil in 1973 and 1979.*

Some researchers are also of the view that the production control by OPEC influenced the oil market in 1970s which aided in the two major crisis. We, hereby, conducted correlation test on the member countries’ production and the global oil prices to verify the theory.

Year	Total OPEC Production (1000 Barrels per Day)	World Oil Prices (US dollar per Barrel)
1970	23300.1	1.8
1971	25208	2.24
1972	26891.1	2.48
1973	30629.5	3.29
1974	30350.7	11.58
1975	26771.1	11.53
1976	30327.11	12.8
1977	30848.05	13.92
1978	29394.78	14.02
1979	30511.28	31.61
1980	26501.44	36.83

*Table: Production of Oil by OPEC and World Oil Prices during 1970s.*



The table above shows the data regarding Total Production (in 1000 barrels/ day) by the OPEC countries (the then members include: Algeria, Indonesia, Qatar, Iran, Iraq, Kuwait, Libya, Nigeria, Saudi Arabia, UAE, Venezuela) and World Oil Prices (US\$/ barrel) from 1970-1980.

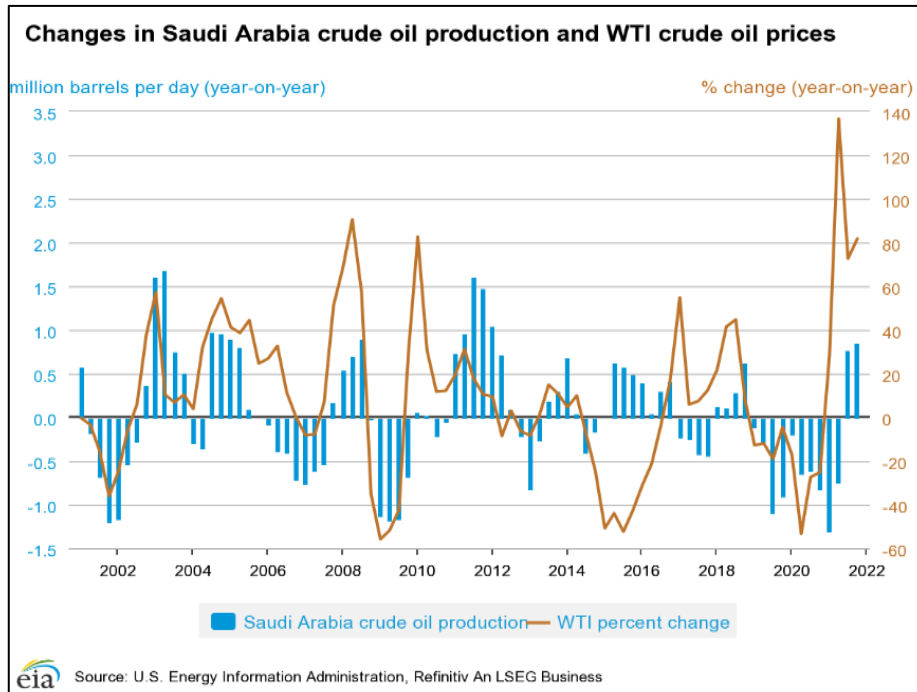
	<i>Total Production</i>	<i>World Oil Prices</i>
Total OPEC Production	1	
World Oil Prices	0.268556949	1

The correlation table above shows correlation between the Total OPEC Production and World Oil Prices. The table gives us a *weak* correlation of 0.2685 showing that the OPEC production had a very less impact in influencing the prices of oil during the period and hence cannot wholly be accused for the oil shocks of 1970s based on manipulation of production. Although we cannot conclude the production manipulation by OPEC during 1970s, but we can say by the theoretical analysis that the policy decision to measure oil prices in terms of gold and the oil embargo set by few countries of OPEC did have an adverse impact on the oil market and led to Oil Shocks of 1970s.

### OBJECTIVE 3

#### TO STUDY THE INFLUENCE OF SAUDI ARABIA AND HOW ITS ROLE HAS CHANGED IN OPEC

The graph given below depicts the changes in Saudi Arabia's crude oil production and WTI crude oil prices:



Source: <https://www.eia.gov/finance/markets/crudeoil/supply-opec.php>

To check the influence of Saudi Arabia in determining the crude oil prices, we look at regression analysis taking crude oil produced by Saudi Arabia as the independent variable and WTI crude oil prices as the dependent variable. Time period for this study is 2001-2021.

Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
9.212725977	3.676576173	2.50579	0.014196	1.898844769	16.52660719
18.9440204	5.229129974	3.622786	0.000504	8.541615103	29.34642569

The P-value comes out to be 0.000504 which is less than the significance level i.e., 0.05. This shows that Saudi Arabia's production has a significant impact on WTI crude oil prices.

The graphs given below show how Saudi Arabia changed its strategy from being a 'Swing Producer' to a 'Tit-for-Tat Producer' during 1985.

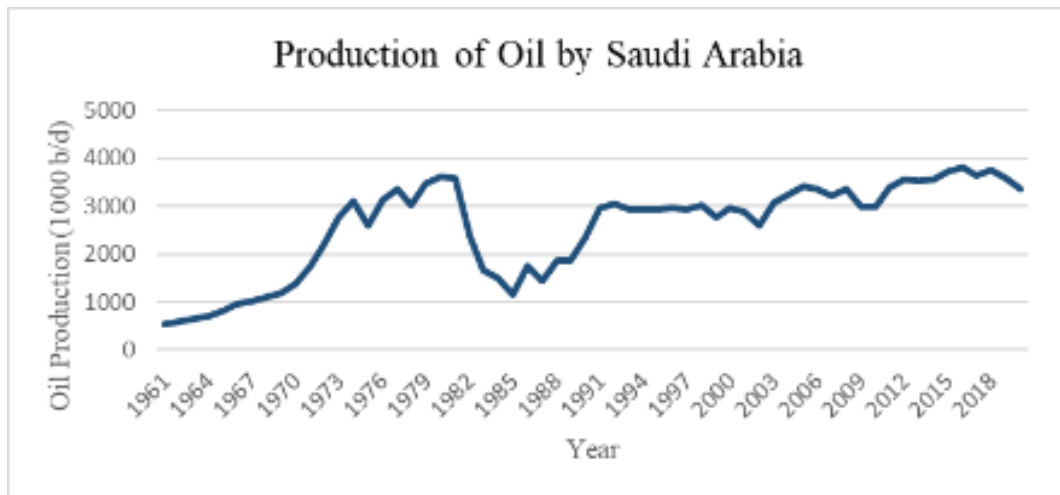


Fig.: Graph showing Production of Oil by Saudi Arabia from 1961-2020

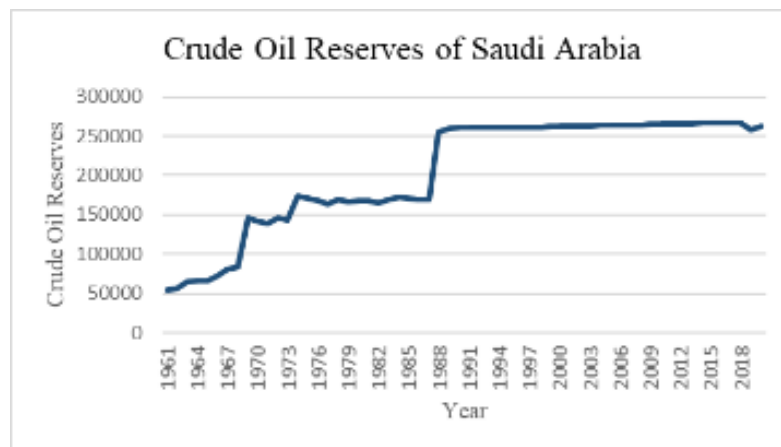
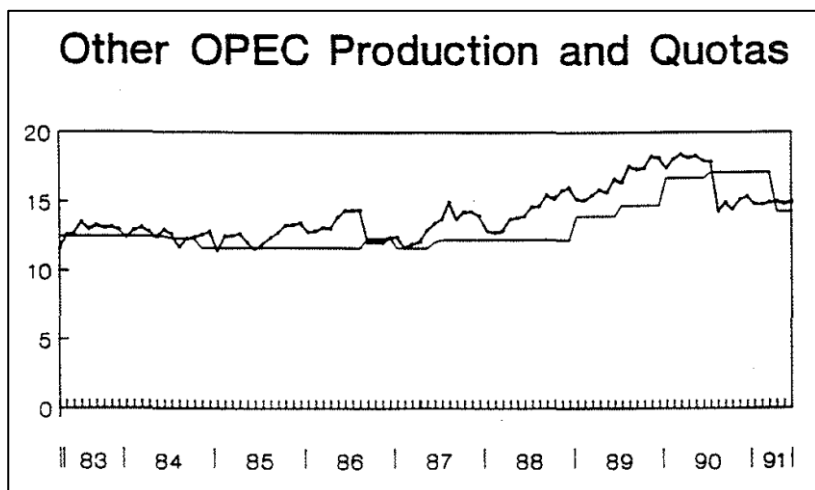
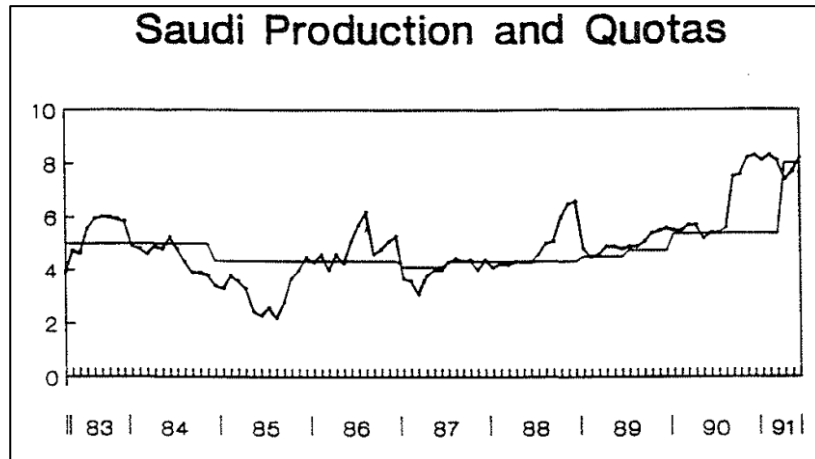


Fig.: Graph showing Crude Oil Reserves by Saudi Arabia from 1961-2020

OPEC producers, other than Saudi Arabia, had been persistently producing in excess of their quotas. Under the swing producer role, the Saudis defended the official price by cutting their own production following the *Swing producer strategy*. By August 1985, Saudi production had dropped to 2.2 million barrels per day and their market share within OPEC stood at 15.1%, despite the 27% market share implied by its official quota. They had no choice but to abandon the swing producer role. In 1985, Saudi Arabia decided to adopt *Tit-far-tat* strategy designed to

punish cheating by matching in some fashion the over production of other OPEC producers. This helped Saudi Arabia to maintain its market share.



Source: "OPEC and World Oil Prices: Is the Genie Back in the Bottle?" by James M. Griffin

Graphs above show production by OPEC countries in excess to the quotas assigned to them and Saudi Arabia changing its strategy from producing less to compensate for other OPEC countries producing in excess before 1985 to punishing these countries by producing in excess to its quota after 1985 itself.

## 7. CONCLUSION

Conducting a thorough analysis for first objective, by applying regression on production and reserves and through quota deviation, we conclude that OPEC members lack unity of decision making and following the policies set by them. They do not act as a ‘cartel’ and hence we can say that OPEC as a cartel is a ‘rational myth’.

Theoretically analysing the Oil Shocks of 1973 and 1979, our second objective, we infer that the policy decision to measure oil prices in terms of gold and the oil embargo set by few countries of OPEC were among the few reasons of Oil Shocks of 1970s. Also, the production of oil by OPEC had a weak correlation with the world oil prices and hence, we conclude that OPEC did not have a major role in production manipulation of 1970s causing Oil Shocks.

For the final objective, by analysing the production of oil by Saudi Arabia and the WTI crude oil prices, we conclude that Saudi Arabia holds a significant impact on influencing global crude oil prices. We notice that when Saudi Arabia changed its policies from being the ‘Swing Producer’ to adopting ‘Tit-for-Tat’ strategy, it punished the other OPEC countries for producing in excess to their quotas and regained its share in the oil market. Summing up our research, we conclude that OPEC majorly holds strategic importance of policy making and oil production and exports in the world but OPEC does not have major influence on World Oil Prices. Thus, we can say that OPEC does not have market power but holds political powers in the global economy.

For further research work, we would advise researchers to explore the topic deeply by taking into account the nuances of World Oil Market and the strategies of OPEC. We faced the limitations of unavailability of data on GDP and Supply of Crude Oil in the World Oil Market for our research and hence, we would recommend researchers to go for further meticulous research in the field.

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## 9. ANNEXURE

- (i) Data Set for Average OPEC and Non-OPEC Production and OPEC and Non-OPEC Reserves from 1961 to 2020:

Year	Average OPEC Production (1000 b/d)	OPEC Reserves (million barrels)	Average Non-OPEC Production (1000 b/d)	Non-OPEC Reserves (million barrels)
1961	332.7833333	185300	674.3633333	61184
1962	366.5883333	190875	711.4633333	65889
1963	405.1616667	204000	746.195	69545
1964	454.45	207675	777.6466667	70972
1965	507.5266667	212900	816.78	75352
1966	571.0733333	231900	879.645	79702
1967	598.4383333	244050	945.8966667	77869
1968	647.1116667	266000	990.045	103457
1969	733.3283333	325500	1028.436667	99296
1970	853.43	335383	1089.25	110601
1971	1021.388333	344323	1121.553333	111569

1972	1144.051667	350668	1159.988333	108580
1973	1343.353333	355838	1193.015	105248
1974	1396.223333	410420	1222.036667	109152
1975	1229.953333	392967	1249.025	111540
1976	1400.633333	385623	1268.893333	110474
1977	1415.208333	381795	1315.918333	110310
1978	1336.125	380084	1379.208333	111046
1979	1387.633333	371654	1408.14	111217
1980	1182.471667	371366	1425.386667	114245
1981	975.7533333	373276	1417.345	113006
1982	811.6466667	396886	1428.69	112538
1983	700.71	404995	1446.313333	113879
1984	666.2983333	437434	1476.541667	115733
1985	621.475	437544	1480.301667	115995
1986	758.4266667	542395	1483.615	115200
1987	740.2456667	571055	1485.345	114572
1988	862.4966667	656479	1474.99	115930
1989	927.7833333	664140	1426.451667	120638
1990	973.8398333	665417	1368.283333	117568
1991	968.0341667	668396	1307.758333	115275
1992	1066.98	669654	1218.721667	113556
1993	1099.79	669806	1156.511667	113667
1994	1118.586667	671265	1104.496667	112905
1995	1116.445	670578	1096.538333	113460
1996	1123.513333	681172	1101.801667	109462
1997	1158.48	681769	1119	112141
1998	1241.603333	684542	1109.411667	131444
1999	1181.781667	691684	1094.305	136691
2000	1264.738333	698096	1127.941667	137969
2001	1224.843333	702583	1169.946667	158084
2002	1089.858333	737129	1234.603333	166780
2003	1219.805	743035	1280.743333	169888
2004	1326.051667	746946	1316.003333	171965
2005	1375.765	751001	1329.943333	174527
2006	1381.165	754151	1348.146667	177450
2007	1341.055	751859	1368.41	162145
2008	1386.986667	753183	1368.576667	162796
2009	1242.366667	753100	1406.298333	165174
2010	1262.408333	795286	1455.105	170068
2011	1383.186667	796882	1475.251667	174657



2012	1461.821667	799889	1536.746667	182402
2013	1439.731667	804171	1612.843333	187078
2014	1423.993333	803925	1710.05	190707
2015	1487.016667	803720	1757.416667	187988
2016	1595.611667	808927	1712.196667	185811
2017	1551.341667	805836	1746.143333	192844
2018	1558.965	803917	1858.951667	197778
2019	1472.986667	855609	1963.265	198686
2020	1332.55	860629	1839.626667	198282

(ii) Data Set for Global Crude Oil Prices from 1961 to 2020:

Year	Global Crude Oil Price (US\$ per barrel)
1961	1.8
1962	1.8
1963	1.8
1964	1.8
1965	1.8
1966	1.8
1967	1.8
1968	1.8
1969	1.8
1970	1.8
1971	2.24
1972	2.48
1973	3.29
1974	11.58
1975	11.53
1976	12.8
1977	13.92
1978	14.02
1979	31.61
1980	36.83
1981	35.93
1982	32.97
1983	29.55

1984	28.78
1985	27.56
1986	14.43
1987	18.44
1988	14.92
1989	18.23
1990	23.73
1991	20
1992	19.32
1993	16.97
1994	15.82
1995	17.02
1996	20.67
1997	19.09
1998	12.72
1999	17.97
2000	28.5
2001	24.44
2002	25.02
2003	28.83
2004	38.27
2005	54.52
2006	65.14
2007	72.39
2008	97.26
2009	61.67
2010	79.5
2011	111.26
2012	111.67
2013	108.66
2014	98.95
2015	52.39
2016	43.73
2017	54.19
2018	71.31
2019	64.21
2020	41.84

- (iii) Data Set for Percentage Change in Production of Crude Oil by Saudi Arabia and Percentage Change in WTI Prices from 2001 to 2021.

Date	Date	% Change in Production (Saudi Arabia)	% Change in WTI Prices
1Q 2001	2001	0.58	-0.38
2Q 2001	2001	-0.18	-3.45
3Q 2001	2001	-0.68	-15.49
4Q 2001	2001	-1.19	-36.16
1Q 2002	2002	-1.17	-24.76
2Q 2002	2002	-0.53	-5.93
3Q 2002	2002	-0.27	5.97
4Q 2002	2002	0.37	38.09
1Q 2003	2003	1.62	57.3
2Q 2003	2003	1.69	10.32
3Q 2003	2003	0.75	6.8
4Q 2003	2003	0.52	10.32
1Q 2004	2004	-0.3	3.78
2Q 2004	2004	-0.36	32.21
3Q 2004	2004	0.98	45.06
4Q 2004	2004	0.97	54.39
1Q 2005	2005	0.9	41.24
2Q 2005	2005	0.8	38.61
3Q 2005	2005	0.1	44.41
4Q 2005	2005	0	24.61
1Q 2006	2006	-0.09	26.86
2Q 2006	2006	-0.38	32.68
3Q 2006	2006	-0.4	11.42
4Q 2006	2006	-0.72	-0.1
1Q 2007	2007	-0.76	-8.25
2Q 2007	2007	-0.62	-7.8
3Q 2007	2007	-0.54	6.64
4Q 2007	2007	0.18	51.15
1Q 2008	2008	0.55	68.5
2Q 2008	2008	0.72	90.52
3Q 2008	2008	0.9	57.25
4Q 2008	2008	-0.02	-35.22

1Q 2009	2009	-1.13	-55.91
2Q 2009	2009	-1.19	-51.84
3Q 2009	2009	-1.17	-42.45
4Q 2009	2009	-0.68	29.51
1Q 2010	2010	0.07	82.68
2Q 2010	2010	0.03	30.55
3Q 2010	2010	-0.22	11.74
4Q 2010	2010	-0.05	12.14
1Q 2011	2011	0.75	19.36
2Q 2011	2011	0.97	31.11
3Q 2011	2011	1.62	17.65
4Q 2011	2011	1.48	10.4
1Q 2012	2012	1.04	9.43
2Q 2012	2012	0.72	-8.56
3Q 2012	2012	0.1	2.99
4Q 2012	2012	-0.21	-6.46
1Q 2013	2013	-0.83	-8.37
2Q 2013	2013	-0.25	0.82
3Q 2013	2013	0.2	14.82
4Q 2013	2013	0.31	10.78
1Q 2014	2014	0.7	4.61
2Q 2014	2014	0.05	9.89
3Q 2014	2014	-0.4	-7.52
4Q 2014	2014	-0.17	-24.91
1Q 2015	2015	0.01	-50.87
2Q 2015	2015	0.63	-44.02
3Q 2015	2015	0.59	-52.43
4Q 2015	2015	0.5	-42.72
1Q 2016	2016	0.4	-31.21
2Q 2016	2016	0.05	-21.42
3Q 2016	2016	0.31	-3.66
4Q 2016	2016	0.42	17.27
1Q 2017	2017	-0.22	54.82
2Q 2017	2017	-0.24	5.82
3Q 2017	2017	-0.42	7.37
4Q 2017	2017	-0.44	12.37
1Q 2018	2018	0.13	21.83
2Q 2018	2018	0.11	41.5
3Q 2018	2018	0.3	44.71
4Q 2018	2018	0.63	7.83

1Q 2019	2019	-0.11	-12.85
2Q 2019	2019	-0.28	-12.03
3Q 2019	2019	-1.1	-19.14
4Q 2019	2019	-0.9	-4.58
1Q 2020	2020	-0.2	-17.31
2Q 2020	2020	-0.64	-53.3
3Q 2020	2020	-0.61	-27.44
4Q 2020	2020	-0.82	-25.26
1Q 2021	2021	-1.31	28.13
2Q 2021	2021	-0.75	136.71
3Q 2021	2021	0.78	72.69
4Q 2021	2021	0.86	81.81

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