

Fossil Fuel Energy Production of OPEC & Non-OPEC Countries and Its Impact on OPEC's Crude Oil Price: An Analytical from 1970s to 2017.

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Abstract

Fossil fuel energy primarily consisting of petroleum products is a biggest driver for growth and development through all sectors both developing and developed world. Oil prices have stagnated over the last 40 years except when there was a boom from early 2000 till 2007-08(oil prices peaked to 147 U.S.Dollars per barrel). After the two oil price shocks in 1970's the writ of OPEC has largely diluted. The OPEC cartel has lost its prerogative in determining price and production. This is primarily due to petroleum production and supply by Non- OPEC countries. Correspondingly there has been substantial growth in the production of non-conventional sources of energy which has, to a great extent, reduced the demand of fossil fuel, petroleum products. The new climate change regime is seriously castigating the use fossil fuel energy instead promoting the use of cleaner energy. This phenomenon will also result in less demand for petroleum products. The present paper traces out the price behavior of crude oil over a period spanning 47 years (1970-2017). The price behavior is captured for the crude oil produced by both OPEC as well as Non-OPEC countries.

Key Words: OPEC

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Introduction:

Oil is a magic word that always makes news. There is hardly a nation that does not seek this indispensable natural resource. Oil or Petroleum is defined in a variety of ways by geologists, chemists, refiners, engineers and lawyers. There is, therefore, no uniformity or full agreement on its definition. However, as it is a natural product forming a part of rocks, geological definition finds more general acceptance. The word petroleum is derived from two Latin words 'Petra' and 'oleum'. 'Petra' means rock and 'oleum' means oil. Petroleum is loosely called "rock oil" or "crude oil". It is a generic term covering a wide range of substances comprising hydrocarbons, which are naturally occurring molecules of carbon and hydrogen. Oil markets have proven exciting since decades. Everyone can ultimately feel the effects of drastic oil price changes. Oil dominated the world energy mix after the second war, with the OECD accounting for 60-70% of world oil consumption. Total and per capita energy consumption was much lower in the developing countries throughout this period, although this trend is now beginning to change. In both regions, there has been a steady increase in the use of gas. Currently, oil accounts for around 40% of the world energy mix. This is because of its unique combination of attributes- sufficiency, accessibility, versatility; ease of transport and, in many areas, low costs. This paper covers an extensive overview over the relationship of oil supply with oil prices during the last few decades. Oil's share of the world energy mix will dip slightly during this period, from 40% to 37 %. (International financial and economic forum, Nov.2004).

The current market for crude oil is truly global in reach. Oil cargoes move with relative ease between countries and across oceans. Because oil can and does move so freely from one area to another across the globe, it is better to think of the oil market as a global pool, rather than as a network of suppliers and buyers. If one supplier shrinks the overall depth of the pool by withholding supply (or floods the pool by producing a lot of oil), then the impact will be felt uniformly throughout the pool. Pricing of oil is determined largely by a mix of supply factors, demand factors and panic. How much of any given oil-price movement is due to each of these three factors is an eternal mystery that keeps a small army of editorial columnists and television talking-heads in business. The supply-demand balance is perhaps the easiest piece to explain - when demand is high (for example, during the wintertime when heating oil demands are high or during the summer when people tend to drive more often and further distances), consumers are willing to pay more for refined petroleum products and higher-cost oil supplies must be brought online. Thus, the price goes up. Similarly, when accidents, political strife or war keep supplies

offline, higher-cost replacements must be found and the price goes up. Panic in the oil market is not always rational, but does happen. Its roots can be traced back to OPEC's successes in the 1970s of increasing world oil prices, even for brief periods. Believing that OPEC had the power to do pretty much whatever it wanted, market participants began engaging in a series of self-fulfilling prophecy games. They worked something like this. First, one or more market participants would believe that OPEC would act to increase prices or reduce supply. Afraid of getting caught short or unable to fulfill contracts, stockpiling commenced, pushing up spot prices. Thus, all OPEC needed to do was cause panic in the markets by spreading rumors of policy changes. The gains were nearly always short lived as the high cost of inventories would result in sell-offs, bringing oil prices down to pre-panic levels. Nowadays, broader geopolitical concerns, particularly in the Middle East and Africa, have replaced the grumblings of OPEC as the source for panic-induced spikes in oil prices.

The increased price of imported oil forces the businesses to devote more of their production to exports, as opposed to satisfying domestic demand for goods and services, therefore cause inflation, even if there is no change in the quantity of foreign oil consumed. Higher oil prices cause, to varying degrees, increases in other energy prices. Depending on the ability to substitute other energy sources for crude the price increases can be large and can cause macroeconomic effects similar to effects of oil price increases. Thus, though energy is the prime mover in an economy, the demand and supply gap of crude oil must be bridged through import to meet the country's requirement, hence, crude oil price is an important parameter in determining reserve position and trade balance and finally balance of payment. Inflation is also an important area arising with the increase of crude oil prices, with the increase of inflation, capacity to purchase is reduced and expenditure increases, saving decreases, ultimately slows down the business and economic activities thus slows down GDP growth.

Environment Problem in the Third World Some of the most serious environmental damage is taking place in the Third World, especially destruction of forests and the loss of species. The resulting famines, floods, erosion and droughts are taking a rapidly increasing number of lives each year. As the trees are lost rain runs off more rapidly, eroding soils and causing more serious flooding, and more serious droughts later on. When there is less wood people burn more dung, which should be going back to the soil. There are now millions of "environmental refugees"; people fleeing because their environments have become unable to support them. To some extent these increasingly serious environmental problems are due to population increase in the Third

World and to corrupt and inefficient governments. But the main causes are the unjust way the global economy functions and the inappropriate approach to development the rich countries have promoted. These have encouraged poor countries to sell off their forests to purchase goods from rich countries. They have led poor countries into debt and thus obliged them to sell even more logs to pay their debts. They have led to the use of much land for export cropping and have therefore forced many poor people to clear forests and to overgraze poor lands in order to grow food for the selves. Other words poverty is a major cause of environmental damage in the Third World. Above all, the "limits to growth" analysis shows that the Third World must be persuaded not to strive for the rich world's industrialized, urbanized and affluent ways. That would require 10 times as much energy and resource consumption as now occurs in the world every year.

We Are Destroying The Life Support Systems Of The Planet

The most serious environmental concern of all is that we are damaging the biological processes that provide and renew the conditions all life on earth needs, such as an appropriate climate and a constant supply of nutrients. Every organism depends for its existence on a fairly stable supply of nitrogen, phosphorus, oxygen, etc. Where did the oxygen we just breathed in come from? It was produced by organisms such as trees and phytoplankton on the surface of the sea. But we are clearing trees and we are allowing ultraviolet rays to damage those micro-organisms. Every major indicator shows deterioration in natural systems. We must see all species and environments as contributing to 8 gigantic system which reproduces the conditions and the chemicals that all need in order to live. We all depend entirely on each other; any organism on earth can only get the things it must have in order to live because all the others are living normally and making those elements and conditions available. Yet we are damaging the system that provides these vital conditions. In recent years, much has been said about the importance of developing renewable energy, especially those sources that come with an 'environmentally friendly' stamp of approval. This need has become even more pressing in the wake of the landmark Paris Agreement on climate change, reached by world leaders in December 2015. However, while it is commendable to support 'green' sources of energy that have the potential to help preserve the planet for future generations, one has to be realistic. The fact is, in the overall energy mix, there is only so much that renewable, such as solar, wind power and bio-fuels, can do to supply the burgeoning levels of efficient, reliable and affordable energy the world requires. That is certainly the case now and one that will see only gradual change in the foreseeable future. All forecasts point to fossil fuels continuing to satisfy the lion's share of global energy demand in the years ahead. Past experience has shown that the energy sector will need to continue to evolve if it is to keep

pace with progress and meet future challenges. In fact, such will be the level of global demand, that all sources of energy — conventional, unconventional, as well as renewable — will likely be required to adequately cover growing consumption levels.

The facts are quite profound: by 2040, OPEC predicts global economic growth doubling from today's levels, as the number of people on the planet expands to over 7 billion. Significantly for the oil sector, which is transportation driven, another 1.2bn people will be behind the wheel of an automobile. Commercial vehicles on the road will double, while air travel will soar. And, in the developing countries, massive potential exists for providing access to modern energy services to billions of people currently without adequate means of heating, cooking and lighting. Translate all these facts into energy demand and unsurprisingly a 50 per cent increase from today's levels is predicted by 2040. Of course, these are just forecasts, which are always subject to change, but even if just half of what is expected today becomes a reality, one constant will remain — fossil fuels will continue to be of paramount importance to the world's economic wellbeing. Surely then, their development should be encouraged and nurtured — certainly not held back.

Statement of the problem:

Crude oil is one of the most economically mature commodity markets in the world. Even though most crude oil is produced by a relatively small number of countries, and often in remote locations that are very far from the point of consumption, trade in crude oil is robust and global in nature. Nearly 80% of international crude oil transactions involve delivery via waterway in supertankers. Oil traders are able to quickly redirect transactions towards markets where prices are higher. Oil prices tended to be high because of rapidly growing demand in the developing world (primarily Asia) from 2000s and peaked to \$147 in July 2008. As demand in these places grew, more oil cargoes headed towards these countries. Prices in other countries also rose as a result. Political unrest in some oil producing nations also contributes to high prices basically, there is a fear that political instability could shut down oil production in these countries. OPEC; the large oil producing cartel, does have some ability to influence world prices, but OPEC'S influence in the world oil market is shrinking rapidly as new bulk supplies in non- OPEC countries are discovered and developed.

The development of our current globalised oil market can be broken down into a few different stages. The first phase was marked largely by intra-company transactions with occasional inter-

company”spot”sales. The second phase was defined by the emergence of OPEC and its attempts to influence an increasingly global oil trade for political ends. The third phase is defined by commoditization of oil markets, with regional prices linked by inter- regional trade and the development of sophisticated financial instruments such as futures and option contracts. Pricing of oil is determined largely by a mix of supply factors, demand factors, panic, technological factors. OPEC operates as a cartel-a group of oil producing countries that attempt to coordinate supply decisions in order to exert some influence on prices. OPEC does not try to set prices directly as is often believed. What OPEC countries try to do is to expand or contract oil production in order to keep the world price within some band that the countries collectively deem desirable. OPEC’s actual ability to manipulate oil prices is not all that clear, and its influence has dwindled as more “unconventional” petroleum resources have been developed, including the oil sands in Canada and shale oil in the United States. Oil is a global market, therefore, once non-OPEC production peaks and demand continues to grow, there will be strong upward pressure on oil prices. Despite the two price shocks in 1973-75 and 1979-1980, oil prices, after adjusting for inflation, have been essentially flat for the past 40 years with no clear trend. This is about to change. Over the next few decades, oil prices are expected to trend upwards and so well above the inflation rate. The world currently has little surplus oil capacity according to Energy International Agency (EIA); spare global capacity is at its lowest in 30 years. Tight capacity is likely to be an ongoing characteristic of the oil market in the future, given the expected slowing in non-OPEC production. With little spare capacity, oil prices will be highly volatile and will respond quickly to any sudden change in demand or supply.

Objectives of the study:

- ✚ To study and formulate the impact of supply of crude oil by OPEC & Non- OPEC nations with Average annual price of OPEC Member Nations.
- ✚ To study the impact of different factors (such as supply & demand factors, political, environmental, technological etc.) in determining price in oil industry.

Literature Review:

In the last ten years, oil has become a global commodity. In this global market, there have been fundamental changes that will have a strong impact on future oil prices. This study examines

these changes, which focus on factors that determine global supply and demand. On the supply side, the main problem is that crude oil reaches the highest point. This refers to the concern that the world runs out of oil and that oil production will soon peak. Oil professionals have made countless predictions about the end of the world over the last two decades at different times and have not materialized. However, there are signs that these pessimistic predictions may be correct at this time and that the era of cheap energy may end. It is surprising that, despite the critical importance of Peak Oil, the theme was not discussed further on. On the demand side, the global composition of demand shifts from the advanced economies of Europe, Japan and North America to developing countries, particularly in Asia. This means that the US impact on the determination of oil prices is becoming less and less a factor. The global energy landscape is changing. Traditional demand centers are being surpassed by fast-growing emerging economies. The energy mix is changing, driven by technological improvements and environmental concerns. It is expected that the global economy will almost double in the next 20 years. Global energy demand is expected to increase by about 30%. The market is gradually adjusting as supply and demand react to lower oil prices. Different mix of fuels and technologies needed to address demand and climate change concerns. The three scenarios reflect different assumptions about the pace of energy transition due to factors such as consumer policy and behavior. The ideas behind Peak Oil were developed by a shell geologist, M. King Hubbert (Hubbert, 1956). In 1956, Hubbert analyzed the production history of a series of oil fields in the USA. He predicted that US oil production would peak in the 1970s, and he named the peak within a few months. Since then, crude oil production has declined in the US, despite the large-scale discovery of Alaska North Slope oil in the late 1970s. Hubbert supporters expect global production to reach the next few years. Most of today's maxima base their prediction on the Hubbert curve, which represents a bell-shaped curve representing exponential growth and declining production (Campbell, 2003, and Deffeyes, 2002 and 2005). The Hubbert curve shows that oil production increases and falls as a direct function of the remaining oil reserves. In other words, production can increase until cumulative production consumes half of the total reserves in the field and then decreases production. What is critical in the analysis is half the point (Campbell, 2003). Once half the oil is exhausted, we have reached a point where there is no return and production will fall, no matter how much new technology is being used or additional drilling is occurring.

Factors impacting the price of crude oil

Crude oil supply:

- Supply greatly influences pricing
- When supply is low, prices increase.
- Supply levels vary based on production and demand.
- OPEC accounts for 40% of all crude oil production in the world and largely impacts the supply and global pricing.
- Increased oil production in the US and Canada have also increased supply and lowered pricing.

Quality of crude oil supply:

- Crude oil pricing is dependent on the levels of viscosity and impurities.

Sweet oil:	Sour oil:
Have fewer impurities	Have more impurities
Harder to find	Requires more processing
Has a higher price	Less expensive due to lower quality

Demand for oil:

- Demand is one of the biggest pricing factors.
- When demand is high, prices increase.
- Demand fluctuates at certain times of the year, which affects the price per barrel of oil.
- Consumers using gasoline regularly helps keep demand and prices stable.

Oil futures market:

- Oil futures market locks in the price of oil at a future date
- The buyer of a future is guaranteed that price at that date regardless of the price at the time.

Future supply and Reserves:

- Governments stockpile oil when prices are low and pull from reserves when prices spike to minimize the impact of increased prices.

Natural disasters and world crisis:

- When a natural disaster or world crisis threatens oil supply or the distribution process, the uncertainty causes volatility in pricing.

Political policies and Upheavals:

- Political instability in a large oil producing area can drive up crude oil pricing.

Weather interruptions and influences:

- Cold weather increases demand for heating oil.
- Warmer weather decreases consumption and causes a surplus.

These factors all impact the price of oil and gas. Luckily, the price of oil today remains mostly balanced. An increase or decrease in price will likely rebound overtime.

(Roberto Bocca, 25th feb.2015). Director of Energy Industries at the World Economic Forum said the long-term prospects for the future of oil prices are compounded by four factors that were not taken into account in previous market shifts. There are more options than in the past. There are not only economically viable alternatives to fossil fuels but also fossil fuels from alternative sources and countries in the form of shale and deep water. We are going to electrify society. The underlying trends are the wealth of natural gas, the development of new technologies and the digitization of the network. Cheaper oil can reduce the consumption of electric vehicles in the short term. Medium-term progress, however, will increase the efficiency of internal combustion engines - currently, an estimated 1 million barrels of oil are wasted in the US due to traffic congestion, which will further reduce oil demand. The pressure to act on climate change is stronger than ever. The business is actively responding to a growing number of companies across the energy spectrum - oil and gas, utilities, energy technology and renewable energy proposals. Some still advocate a clear carbon price policy with a defined cost path as a possible solution. The UN Conference on Climate Change COP21 in Paris later this year could be a significant milestone. Technological innovation is a great unknown. In the energy sector, as in any area of life, there is great uncertainty about the impact of rapidly evolving innovations in areas such as large data, nanotechnology and artificial intelligence. Some implications are conceivable, for example. Improving efficiency through better traffic management, optimizing the network and

reducing errors due to human error, but there will likely be impacts that no one has ever thought of. None of this means that the lower oil price represents a structural change in the long run. However, it is at least plausible that we see the development of a "new normal" with the OPEC energy change due to the increase in oil and gas in North America and other regions and the increasing viability of a wide range of alternatives. In this perspective, the recent decline in the price of oil could mean that geopolitics is becoming increasingly multipolar, perhaps also the energy world that is entering multipolarity.

(UN Climate Change Conference COP23, 2017) To achieve the goal of the Paris Accord of keeping warming "well below" 2 ° C, the world must now act to reduce the consumption and production of coal, oil and natural gas. However, the agreement disguised the issue of fossil fuel production. A new SEI (Stockholm Environment Institute) document notes that countries can take action to deal with fossil fuel production using the existing UNFCCC process and the terms of the agreement. They can commit to fossil fuel production targets, implement controlled reduction plans and transition to affected communities, and eliminate current financial support, leading to increased fossil fuel production. The document comes at the UNFCCC climate conference in Bonn, Germany, where negotiators will discuss the development of the "regulatory framework" for implementing the Paris Accord."The opportunity is here to plan a decline in fossil fuels," said SEI researcher, Georgia Piggot, the paper's lead author. "Everyone in Bonn has to think about how he can incorporate this into the parts of the Paris Accord where they take responsibility."The UNFCCC is the most important process for negotiating the international response to climate change. If they are not fossil fuels, it will be easier for governments, industries and other stakeholders to be vague about plans to cut fossil fuel production.

Research methodology

The data has been collected through secondary sources. The sources include the journals, books, magazines, published reports and web portals. The data on the history of oil market was collected from official websites of International Energy Agency, US Energy Information Administration, U.S. Also, Department of Defense and U.S. department of Energy, British Petroleum etc. Business magazines and some newspapers like 'The Times of India', 'The Economic Times', and 'The Financial Express' were used for the update of current trends in the oil market. Further, data was analyzed through statistical tools like regression analysis and

correlation analysis. After collected the information, data was carefully scrutinized and coded, so that all the information could be brought to proximity. Analysis was done by computing percentages, chi-square analysis, level of significance, ANOVA, regression and correlation. The level of significance were obtained at the p-value of <0.01, <0.05 and >0.05.

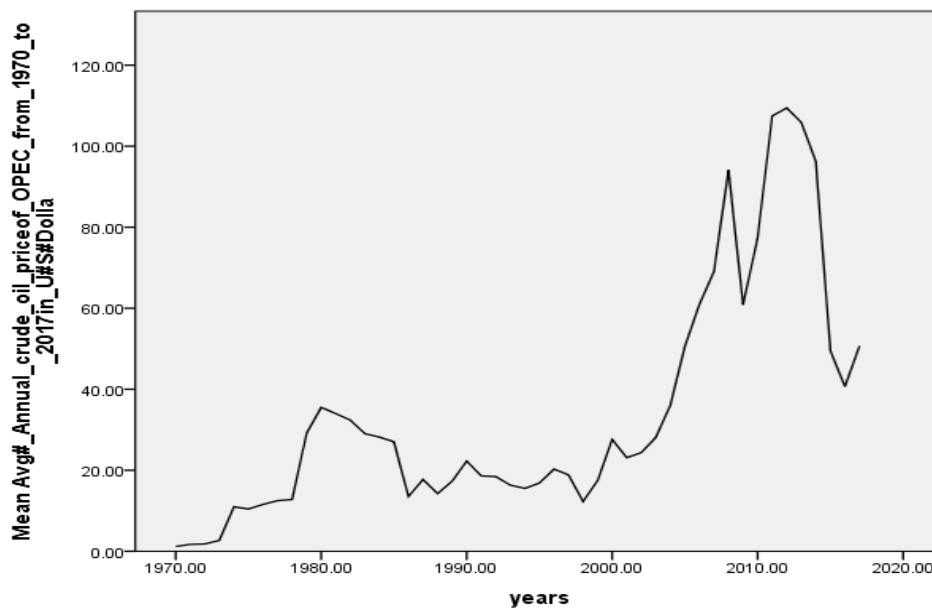
Variables:

Dependent variable	Independent variable
Crude oil price	Crude oil supply

Correlation Analysis: Pearson’s correlation coefficient has been used to determine the nature of relationship that exists between Crude oil supply (Independent Variable) and crude oil price (Dependent Variable). Table 2 shows the correlation of total crude oil supplies [mb/d] of OPEC & Non- OPEC countries with the total crude oil price [in U.S.Dollars per barrel]

Regression Analysis: - Regression analysis predicts the relationship between the variables i.e. Total supply of crude oil by OPEC & NON-OPEC [mb/d] which is the independent variable and Avg. Annual crude oil price of OPEC in U.S.Dollars per barrel being the dependent variable.

Figure 1: Average annual price of OPEC countries from 1970 to 2017



Given the critical role played by crude oil, events in the oil market have a major impact on overall economy. Over the past 50 years, oil prices have moved in a wide range. As shown in Figure 1, between 1970 to 2017, oil prices are measured. The world economy faced two major oil shocks in 1973-74 and 1979-80, both of which were largely due to cutbacks in OPEC

production. In 1973-74, oil prices rose from \$2- 3 a barrel to about \$11-12 a barrel and then in 1979-1980 they spiked up again to about \$39 a barrel. During both oil shocks, the US and much of the global economy moved into recession and unemployment rates rose sharply. The recent fall in oil prices to less than \$50 per barrel and the rebound to \$60 per barrel took many by surprise, following three and a half years of relative stability at around twice that level. Yet a longer-term view of history shows that prices have always fluctuated, for reasons including demand, supply, geopolitical tensions and OPEC intervention. At the end of the 1990s, for example, the price dropped below \$20 per barrel. Does that mean that what comes down must go up, and it is only a matter of time before the recent dramatic fall is significantly reversed? Not necessarily. Oil prices peaked in April 1980 at \$39.50 a barrel and then steadily declined for almost 20 years, until they bottomed out in December 1998 at \$11.28 a barrel. This 20-year period of fall in prices set the stage for the price surge over the past decade. Investments in the oil industry became unprofitable and there was no longer much of an incentive for consumers to conserve energy. As a result, oil companies cut back on their capital budgets and oil rig counts and drilling activity fell sharply. The relatively low price of oil at the pump encouraged consumers to buy less fuel-efficient vehicles and bigger homes. Crude prices starting edging up again at the end of 1990's, but the upward price spike did not become noticeably pronounced until late 2003, with oil prices rising sharply between 2003 and 2008 and reaching a peak of over \$130 a barrel in July 2008. The deepest and longest global recession in the post-World War II period that began in December 2007 and lasted through the middle of 2009, dramatically reduced oil demand and oil prices. Prices for WTI fell from over \$130 a barrel in the summer of 2008 to a low of \$31 in December 2008. Despite sluggish recovery in advanced countries and record levels of inventories, oil prices trended upwards since the recession ended in 2009 and touched over \$100 a barrel by the spring of 2012. Oil prices are now at levels that are well above those experienced prior to the global recession. Oil prices (WTI) averaged around \$56 a barrel in 2005 and \$66 a barrel in 2006 at a time when the global economy was expanding at a rapid rate. The question is why are oil prices so high given the sluggish rate of growth in the overall global economy? No one expects the global economy to run out of oil anytime soon. The concern is that the upward trend in oil production, that has been evident over the past century, will reach a point of maximum production and then decline. The question is, when will global oil production peak and how will it affect the global economy? The date when peak production occurs is a source of much debate among participants in the energy market.

Table 1: Correlation between OPEC Production & Supply of crude oil

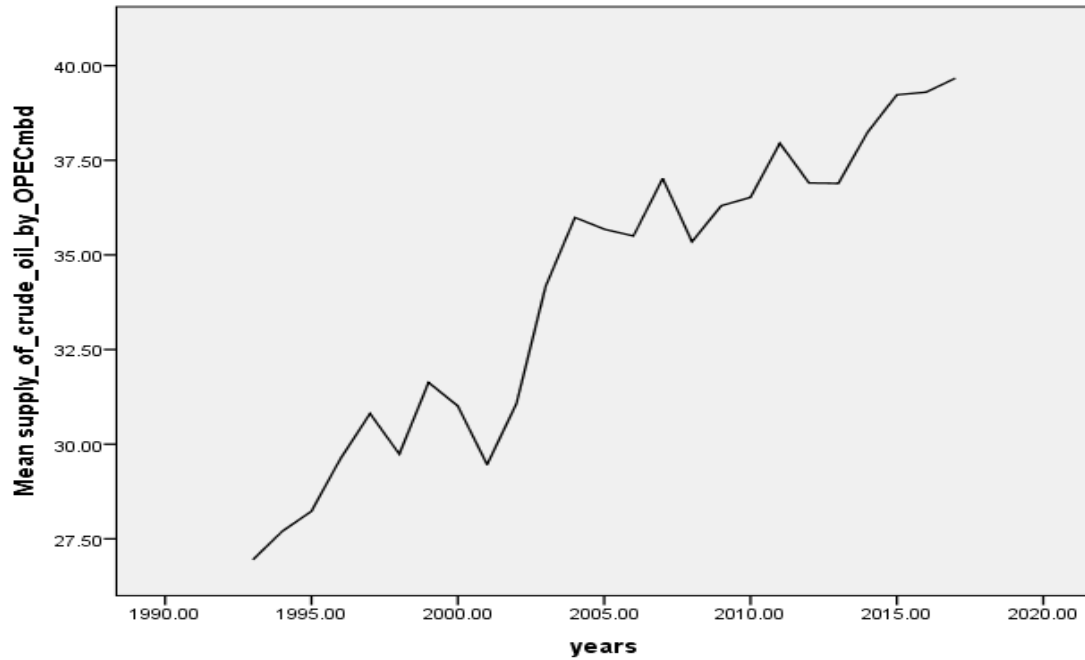
Correlations

		OPEC's Total Crude Oil Production [million barrels per day]	OPEC's Total Crude oil supply [million barrels per day]
OPEC's Total Crude Oil Production [million barrels per day]	Pearson Correlation Sig. (2-tailed) N	1 28	.919** 25
OPEC's Total Crude oil supply [million barrels per day]	Pearson Correlation Sig. (2-tailed) N	.919** .000 25	1 25

** . Correlation is significant at the 0.01 level (2-tailed).

Table 1 it shows the correlation of total crude oil production [mb/d] of OPEC countries with the total crude oil supply [mb/d] of OPEC. It shows that there exists a perfect positive correlation of ($r=0.919$, $p>0.01$). It also shows that there exists a significant positive correlation between crude oil productions [mb/d] of OPEC countries with crude oil supply. Therefore, it can be said that an increase in crude oil production will lead to a significant increase in crude oil supply and vice-versa, in proportion of their correlation.

Figure 2: OPEC's Total Crude oil supply [million barrels per day]



Crude oil production by the Organization of the Petroleum Exporting Countries (OPEC) is an important factor that affects oil prices. This organization seeks to actively manage oil production in its member countries by setting production targets. Historically, crude oil prices have seen increases in times when OPEC production targets are reduced. OPEC member countries produce about 40 percent of the world's crude oil (OPEC's Annual Bulletin, 2015). Equally important to global prices, OPEC's oil exports represent about 60 percent of the total petroleum traded internationally. Because of this market share, OPEC's actions can, and do, influence international oil prices. In particular, indications of changes in crude oil production from Saudi Arabia, OPEC's largest producer, frequently affect oil prices. The extent to which OPEC member countries utilize their available production capacity is often used as an indicator of the tightness of global oil markets, as well as an indicator of the extent to which OPEC is exerting upward influence on prices. EIA defines spare capacity as the volume of production that can be brought on within 30 days and sustained for at least 90 days. Saudi Arabia, the largest oil producer within OPEC and the world's largest oil exporter, historically has had the greatest spare capacity. Saudi Arabia has usually kept more than 1.5 - 2 million barrels per day of spare capacity on hand for market management. OPEC spare capacity provides an indicator of the world oil market's ability to respond to potential crises that reduce oil supplies. As a result, oil prices tend to incorporate a rising risk premium when OPEC spare capacity reaches low levels. From 2003 through 2008, OPEC's total spare capacity remained near or below 2 million barrels per day (or

less than 3 percent of global supply), which provided very little cushion for fluctuations in supply in a context of rapidly rising demand. Markets are influenced by geopolitical events within and between OPEC countries because they have, historically, resulted in reductions in oil production. Given OPEC's market significance, events that entail an actual or future potential loss of oil supplies can produce strong reactions in oil prices. Despite OPEC's efforts to manage production and maintain targeted price levels, member countries do not always comply with the production targets adopted by the organization. Oil prices can be affected by member countries' unwillingness to maintain production targets. In addition, unexpected outages can reduce OPEC production. The amount of the disruption, how quickly it occurs, and the uncertainty of restoring the output has considerable influence on oil prices. Natural gas liquids (NGLs) are not included in OPEC production allocations and can provide substantial additional volumes to world liquids supply. The behavior of oil prices depends not only on current supply and demand, but also on projected future supply and demand. OPEC adjusts member countries' production targets based on current and expectations of future supply and demand. Estimating future supply and demand, however, is especially challenging when market conditions are uncertain and are changing rapidly. There can also be significant lags in OPEC production target adjustments in response to market conditions, which also can impact prices.

Figure3: OPEC’s Total Crude oil supply curve [million barrels per day] & Avg.annual price of OPEC

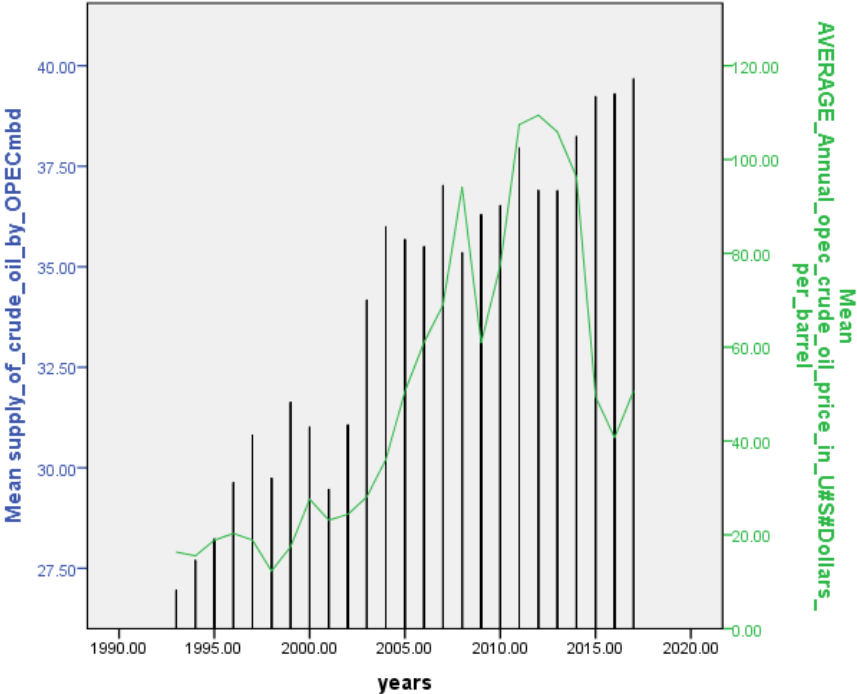


Figure 3 show that there exists an inverse relationship between OPEC’s crude oil supply with the Avg.annual price of OPEC. Therefore, it can be said that an increase in crude oil supply in OPEC

countries will lead to a reduction in Avg.annual price of OPEC and vice- versa. Oil prices have dropped more than 50 percent since mid-2014. Establishing whether demand or supply factors lie behind this slump is possibly useful for understanding its potential impact on the economy. The figure tells the following story: Between 2003 and mid-2008, aggregate demand shocks induced a run-up in oil prices. During the 2008 financial crisis, negative oil-specific demand shocks together with negative aggregate demand shocks caused a sharp decline in the price of oil. Following the financial crisis, positive oil-specific demand shocks and negative aggregate demand shocks resulted in roughly constant oil prices. After mid-2014, the lion’s share of the decline in oil prices has been caused by negative oil-specific demand shocks and, to a lesser extent, by negative aggregate demand shocks. In contrast, the role of the oil supply (understood as the current physical availability of crude oil) has been small.

Figure 4: Shows inverse relationship between total supply and price

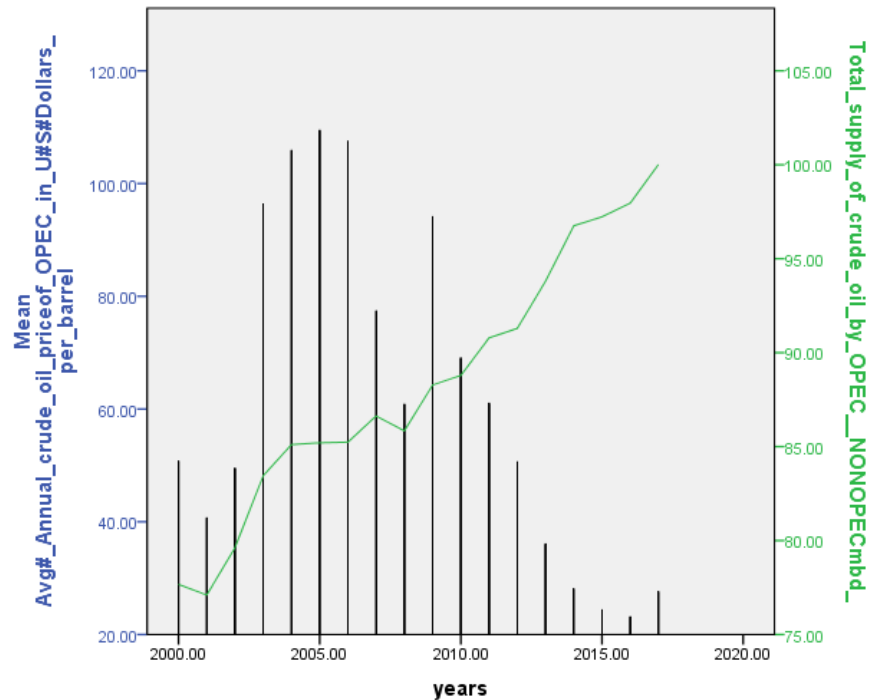


Figure 4 shows the inverse relationship between total crude oil supplies [mb/d] of OPEC & Non-OPEC countries with the total crude oil price [in U.S.Dollars per barrel]. It indicates a moderate negative relationship [fuzzy-firm linear rule] ($r = -0.489$, $p > 0.05$). Therefore, it can be said that

when the supply of crude oil increases among OPEC & Non- OPEC nations will lead to a significant decrease in crude oil price and vice- versa.

Correlation Analysis

Table 2: Correlation between Total Crude oil supplies from OPEC & Non-OPEC Countries with Crude oil price from 2000 to Nov.2017

Correlations

		Total Crude oil supplies from OPEC & Non-OPEC in million barrels per day	Crude oil price from 2000 to Nov.2017 in U.S.Dollars
Total Crude oil supplies from OPEC & Non-OPEC in million barrels per day	Pearson Correlation Sig. (2-tailed) N	1 18	-.489* 18
Crude oil price from 2000 to Nov.2017 in U.S.Dollars	Pearson Correlation Sig. (2-tailed) N	-.489* .040 18	1 18

*. Correlation is significant at the 0.05 level (2-tailed).

Pearson's correlation coefficient was used to determine the nature of relationship that exists between Crude oil supply (Independent Variable) and crude oil price (Dependent Variable). Table 2 shows the correlation of total crude oil supplies [mb/d] of OPEC & Non- OPEC countries with the total crude oil price [in U.S.Dollars per barrel]. It indicates a moderate negative relationship [fuzzy-firm linear rule] ($r = -0.489$, $p > 0.05$). Therefore, it can be said that when the supply of crude oil decreases among OPEC & Non- OPEC nations will lead to a significant increase in crude oil price and vice-versa, in proportion of their correlation.

Regression Analysis:

Table 3
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.489a	.239	.191	27.18820

a. Predictors: (Constant), Total supply of crude oil by OPEC & NON-OPEC [mbd]

TABLE4
ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3711.962	1	3711.962	5.022	.040b
	Residual	11827.174	16	739.198		
	Total	15539.136	17			

a. Dependent Variable: Avg. Annual crude oil price of OPEC in U.S.Dollars per barrel

b. Predictors: (Constant), Total supply of crude oil by OPEC & NON-OPEC [mbd]

TABLE 5

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	251.878	85.070		2.961	.009
1 Total supply of crude oil by OPEC & NON-OPEC [mbd]_	-2.151	.960	-.489	-2.241	.040

a. Dependent Variable: Avg. Annual crude oil price of OPEC in U.S.Dollars per barrel

In Table 3 the value of R square shows that 23.9% variation in Avg. Annual crude oil price of OPEC in U.S.Dollars per barrel (Dependent Variable) is explained by Total supply of crude oil by OPEC & NON-OPEC [mb/d] (Independent Variable) and the rest of the 27.18% variation in Avg. Annual crude oil price of OPEC in U.S. Dollars per barrel may be attributed to other factors .The significance of the model in terms of overall fit is expressed by F=5.022 with a significance level of 0.040 which is less than 0.05. Thus, it is acceptable and shows strong impact of independent variable on the dependent variable. Table 5 also shows the Beta values of study variables that depict the individual influence of independent variable on the dependent variable. Results reveal that among the dimensions of SUPPLY has a significant negative on price with a beta value of -0.489. this means that 48.9% variation in price is caused due to supply .it shows that supply has an significant Negative influence on price with a beta value of -0.489 which is

insignificant at 0.05 level (i.e., $p > 0.05$), From the results of regression analysis, it can be concluded that supply is the significant predictor of price among the OPEC & Non- OPEC Member nations.

Conclusion:

Oil prices and supply of oil have always formulated a relationship that has ever impacted the energy market throughout the history. With the rise in production / supply there has been a corresponding fall in the prices and vice-versa. The increase in production by non-OPEC countries has also resulted in incremental supplies of fossil fuels which have impacting the price behavior though, marginally. Ever since the cessation of rule of thumb by OPEC countries with regard to production and price determination, the game altogether changed. The research analysis done in the foregoing pages bear testimony to the fact that the three major variables viz., production , supply of OPEC & Non-OPEC Countries & price behavior have been important criterion for determination of world output for agriculture, industry & tertiary sector. The study shows that there exists an inverse relationship between total crude oil supplies of OPEC & Non-OPEC countries with the crude oil price. It indicates the moderate negative relationship [fuzzy-firm linear rule]. Therefore, it can be said that when the supply of crude oil increases in OPEC and non-OPEC countries, the cost of crude oil will come down drastically and vice versa. It also shows that there exists a perfect positive correlation of OPEC's total crude oil production with the total crude oil supply. Therefore, it can be said that an increase in the production of crude oil will lead to a significant increase in the supply of crude oil and vice versa proportional to its correlation. Crude oil production by the OPEC is a major factor influencing oil prices. This organization seeks to actively control oil production in its member countries, setting production targets. In the past, crude oil prices have increased at a time when OPEC's production targets are being reduced. OPEC member countries produce about 40 percent of the world's crude oil. Equally important for global prices are OPEC's oil exports, which account for about 60% of the world's traded oil. Because of this market share, OPEC measures can and should influence international oil prices. The price of oil is determined largely by a combination of factors such as demand, supply, environment, as well as technological and political factors. Markets are affected by geopolitical events within and between OPEC countries, as in the past led to a reduction in oil production. Given the importance of the OPEC market, events that result in actual or future potential loss of oil supplies can cause strong reactions to oil prices. It again shows us that there is an inverse relationship between the OPEC's supply of crude oil with the

average price of OPEC. Therefore, it can be said that an increase in the supply of crude oil in OPEC countries will lead to a reduction in the average price of OPEC and vice versa. Since mid-2014, oil prices have fallen by more than 50%. The facts are quite profound: by 2040, OPEC predicts global economic growth doubling from today's levels, as the number of people on the planet expands by 1.7 billion. Significantly for the oil sector, which is transportation driven, another 1.2bn people will be behind the wheel of an automobile. Commercial vehicles on the road will double, while air travel will soar. And, in the developing countries, massive potential exists for providing access to modern energy services to billions of people currently without adequate means of heating, cooking and lighting. Translate all these facts into energy demand and unsurprisingly a 50 per cent increase from today's levels is predicted by 2040(OPEC bulletin, April 2016).

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