

# Shale oil & OPEC

Has the rise of shale weakened OPECs market power in the short and long run?



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# 1. Introduction

## 1.1. Abstracts

Since 2014, the world have experienced a different world in terms of oil prices. There has been an oversupply in the market as well as lower demand growth than expected. Especially the rise of the shale oil industry in the US took analysts and experts by surprise and the extra supply from shale oil was not calculated in forecasts.

As prices plummeted, the world looked to OPEC, which had traditionally taken on the role of being a swing producer. When OPEC had their meeting in November of 2014, the market expected them to cut in production to stabilize the market. Instead, OPEC decided to stay with the same levels and we saw a further decrease in oil prices.

OPEC have been characterized as a cartel in the literature, but through using Alhajii & Huettner's (2000a) six characteristics of a successful cartel, it seems evident that shale oil has had its impact on OPECs market power in the global oil market and that the cartel is not as efficient and successful as it might have been in the past. While some of the characteristics of a successful cartel seems to have been missing from the establishment of the organization, others are fulfilled. Some of the characteristics, which make a cartel, has not been impacted by the rise of shale oil, other have clearly set its mark and have affected OPECs ability to respond and stabilize the market. One direct result of the rise of shale oil has been changes in OPECs export as well as their percentage of total world consumption.

One of the most important channels OPEC has had in utilizing their market power has been through their spare production levels, which are now at low levels.

As a response to lower oil prices, OPEC has in the past cut production levels, to a point where supply meets demand. This has had some success in the past as non-OPEC producers have traditionally had higher cost levels than OPEC and could not compete at low oil prices. This has changed with the shale oil revolution. Break-even prices of some shale oil fields range all the way down at \$40, meaning that oil prices above this, they can still make money. As of June 2017, OPEC has not been able to raise the prices significantly and has made a plea to the US to join the production cuts, as it seems they are not able to do so themselves. In my opinion however, it seems as though OPEC is still an important player in the market, but that

they have lost some of their market power due to shale. As we saw prices respond shortly after their announcements, it seems that OPEC have power and influence in the short run, but that in the long run, it is difficult to influence more heavy and long run price shocks as there are many other factors influencing the market.

## 1.2. Background and motivation

The oil market plays such an important and strategic role in the global market. It influences our everyday lives and the oil price and fluctuations impact us both in an economical way and also geopolitical. The last couple of years we have seen a crash in the oil market. This has coincided with the rise of shale oil, especially in the U.S. The price plunge we have seen has hit hard. In Norway, we have seen several business go under as a direct result of low oil prices, as investments stopped. Businesses has had reduce much of their work force and the “golden ages” in the oil industry came to a quick stop as the decline of the oil price was a fact.

OPEC, traditionally being the swing producer, and self-proclaimed stabilizer in the market, did not seem to be able to rise prices. I find it very interesting to look further into the shale oil revolution and if it has influenced OPECs market power and its stability to influence oil prices. Therefore I wanted to study OPECs market power and if it has been impacted by the shale oil revolution.

## 1.3. Objectives and contributions

My objective with this paper is to get a better understanding of OPECs market power, and how the shale oil revolutions have impacted it. In the first chapter, I try to make a simplified overview of how the oil market works, and how the oil price has changed in accordance to major events in the global economy. I have presented theoretical models and literature overview. In the analysis, I look at what happened in the 2014 oil price plunge, and have we seen similar drops before? How has OPECs market power evolved through time and how shale oil impacted the global oil market?

My contribution is an analytical review of OPECs role in the oil market. Whether they fit the cartel model and the impact shale oil has had on OPECs market power.



## 1.4. Related research

OPEC production has been discussed and analyzed by many, such as Alhajji & Huettner (2000). Hansen & Lindholdt (2008) applied an econometric model to test the market power of OPEC from 1973 to 2001 as well as Golombek, Alfonso & Lin Ma (2015). Hamilton (2003) has studied price shocks and events associated with these. The oil price decline in 2014 is thoroughly described and analyzed in *The Great Plunge in Oil Prices: Causes, Consequences and Policy Responses*. In addition to academic literature, there is also much information to found on the International Energy Agency (IEA) and OPECs monthly bulletins and statistics.

## 1.5. Limitations and challenges

This paper does not go in-depth. Rather, the emphasis has been made on understanding the overall picture. My focus and analysis has been on crude oil and has not included gas and other refined products, although this would have been interesting to include.

Collecting data proved more difficult than first anticipated. Numbers were often different from various authors and production numbers as well as OPEC quotations were difficult to grasp as different sources had different understandings and definitions.

During the writing of this paper, the market conditions also changed, oil prices fluctuated and the oil market also so. OPEC had their last meeting on May 26<sup>th</sup> deciding to continue their production quota, which due to time limits I did not have the time to include in its fullness.

## 2. An understanding of the oil market

### 2.1. Crude oil

Even though there are some disagreements as to how fossil fuel is formed, most scholars agree that it is a result of millions of years of decomposition of buried dead organisms. Given the long decomposition time before becoming crude oil, the commodity is defined as a non-renewable asset. An asset of economic value that cannot be easily replaced (Kronenberg, 2008).

### 2.2. Different oil grades and quality factors

Crude oil can be divided into several categories, depending on its qualities, blend and the location of extraction. Reservoirs around the world differ in which type of oil they contain. The main quality measurement of oil is the viscosity, which range from light, medium, heavy and extra heavy. The American Petroleum Institute introduced a standard for differentiating between different oil grades by comparing its weight to water. The measure is called API gravity and a number greater than ten means that the oil is lighter and floats on water, where a number less than ten shows that it is heavier than water and will sink (Schenk, Pollastro & Hill, 2006).

The most used reference for oil in Europe is the Brent blend, which is used as a reference on approximately 65 percent of all crude oil contracts in the world. (Kurt, 2015). Brent refers to oil extracted from four different fields in the North Sea. They are easy to transport since it is delivered across the oceans, and can therefore fast and easy be delivered all over the world.

The West Texas Intermediate (WTI) is oil from the US, transported through pipelines, which makes it much more expensive to transport. Still, it is the main benchmark for oil sold in the US. In the Middle East, the most used reference for oil is Dubai/Oman. The reference has been the main market price reference for crude oil delivered to Asian the Middle East. The OPEC reference basket is also an important reference even though it is not an oil blend as the previous mentioned references. This is a weighted average of prices for petroleum blends produced by OPEC countries.

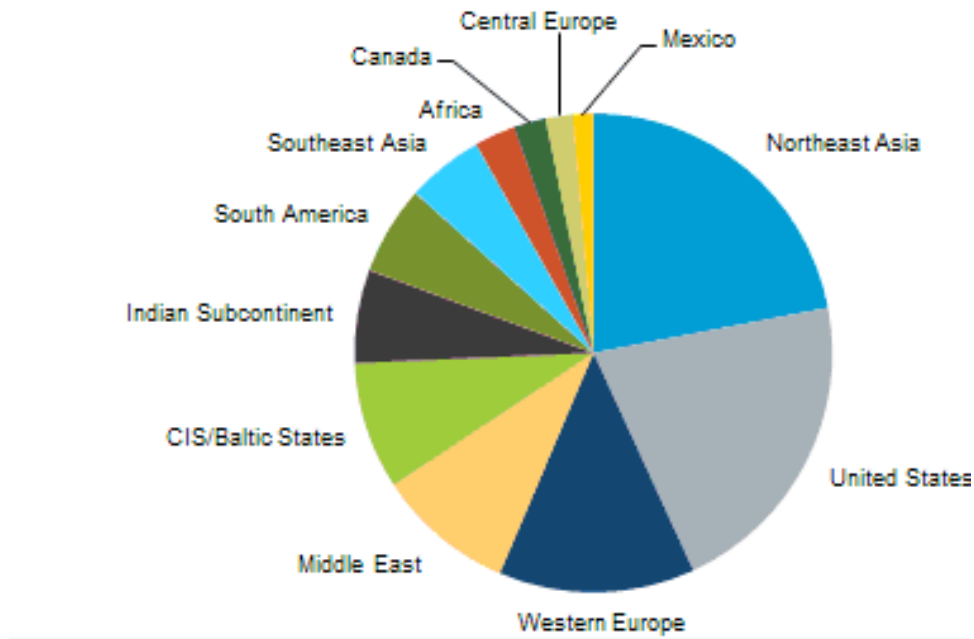
There is also a distinction between conventional and unconventional oil, where there are different extraction methods for pumping the oil. Conventional oil refers to oil that is located between rock formations and are free flowing. A rig can drill a well down to the oil pool and the only pressure needed to pump the oil is the natural pressure that occurs from drilling a well. Unconventional oil on the other hand cannot be extracted using this method. The oil is often located in layers and instead of one big pool, they are often found in small quantities. Horizontal drilling is used to reach into the layers and instead of having a rig drill and a well; a method called fracking is often used. This creates fractures in the layers and rocks surrounding the oil, allowing the oil to flow more freely and to make it easier to extract (Saniere, 2007).

It is important to understand that oil is not homogenous and that it takes different extraction methods to produce. This will be used later as part of the analysis. Especially the difference between conventional and unconventional oil is of importance in this paper as OPEC production is defined as conventional and shale oil is extracted using the fracking method and is defined as unconventional. Being two different production methods, we have also seen differences in the marginal cost of extraction. As I will show in this paper however, the cost picture has changed dramatically during the last decade.

### 2.3. Demand

Demand for crude oil is impacted by the demand for refined oil products (Happonen, 2009). The different world regions have historically had different demand for crude oil. Figure 1 shows consumption of oil divided by regions. In 2015, Northern Asia, the United States and Western Europe were consuming more than half of the crude oil on worldwide basis (IHS, 2016). Emerging markets have traditionally been high in consumption of oil, and from the 1960s to 2010, emerging market's share of global energy consumption has more than doubled (Holmes, 2010). According to BP (2017), global energy demand will increase around 30 percent in 2035, mainly due to emerging economies.

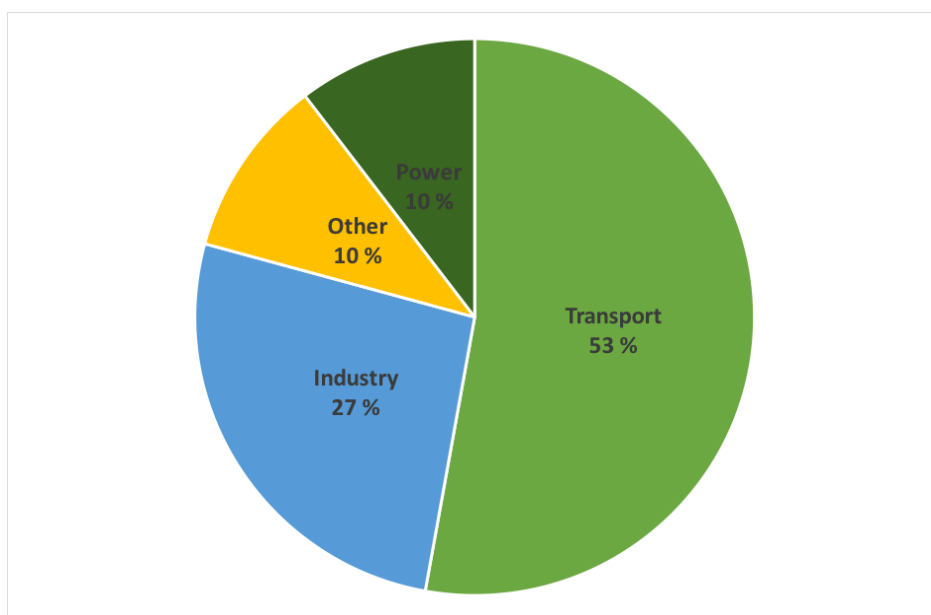
Figure 1 **WORLD CONSUMPTION OF CRUDE OIL IN 2015**



(IHS, 2016).

Figure 1 shows global oil demand per sector in 2015. From the figure, we see that demand for oil is mainly driven by two sectors, the transportation and the industrial sector.

Figure 2 **GLOBAL OIL DEMAND BY SECTOR IN 2015**



Authors own model with data retrieved from BP (2016).

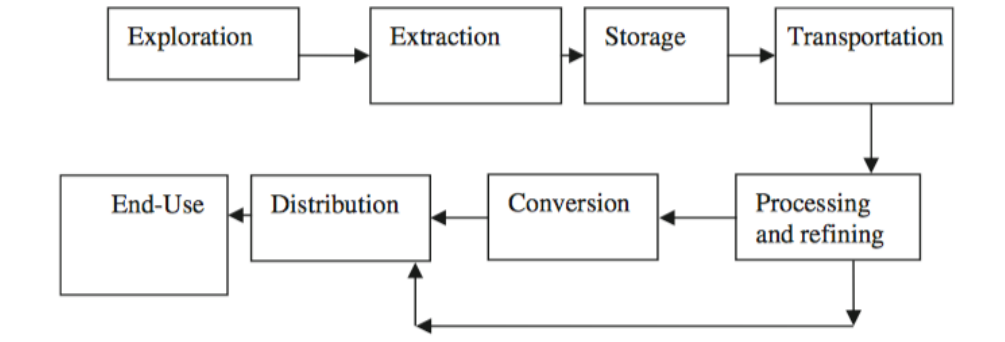
Looking at figure 2, we see that the transportation industry stood for 63,5 percent of the total global energy consumption. The growth of crude oil demand for the transportation sector more than doubled from 1973 to 2012 (Global Petrol Prices, 2015). In 2012, 95 percent of the transportation sector were run on oil in the US (Bettinger & Mesnikoff, 2010). At the same time, even though the demand in these sectors are high, they can also easily be substituted to more energy friendly methods for production in the long run. If prices of oil and thus gasoline rise, it might be substituted for another energy source lowering the demand for oil. An increase in oil prices could lead to higher motivations for R&D and investment in alternative and more energy efficient solutions. Already, we are seeing changes in the car pool, where we now see more fuel-efficient cars, electric, hybrids etc. (Arezki et al (2017)).

The other industry highly represented is the industrial sector, where especially the production and heating processes involved in fabrication and production are big consumers. In addition, oil is often used as raw material in production processes and can be found in many everyday products. In addition, here, we have seen that governments around the world have introduced incentives for more energy efficient production methods.

## 2.4. Supply

Fossil fuel is found underground and therefore finding it and extracting it can be, and is often a costly matter (Bhattacharyya, 2011). Different countries have different policies when it comes to the process of discovering and extracting oil, but nonetheless the process can be simplified as shown in figure 3. First, there is a lengthy and complicated process of exploration, which is normally done by an oil company. There is often large uncertainties in regards to the size of the oil fields, and thus the process before extraction starts is often very long and costly. After the decision to start extraction the oil needs to be stored, transportation and processing. After the crude oil has been processed, it is sold on the spot market and distributed to refineries before eventually to end up with the end users.

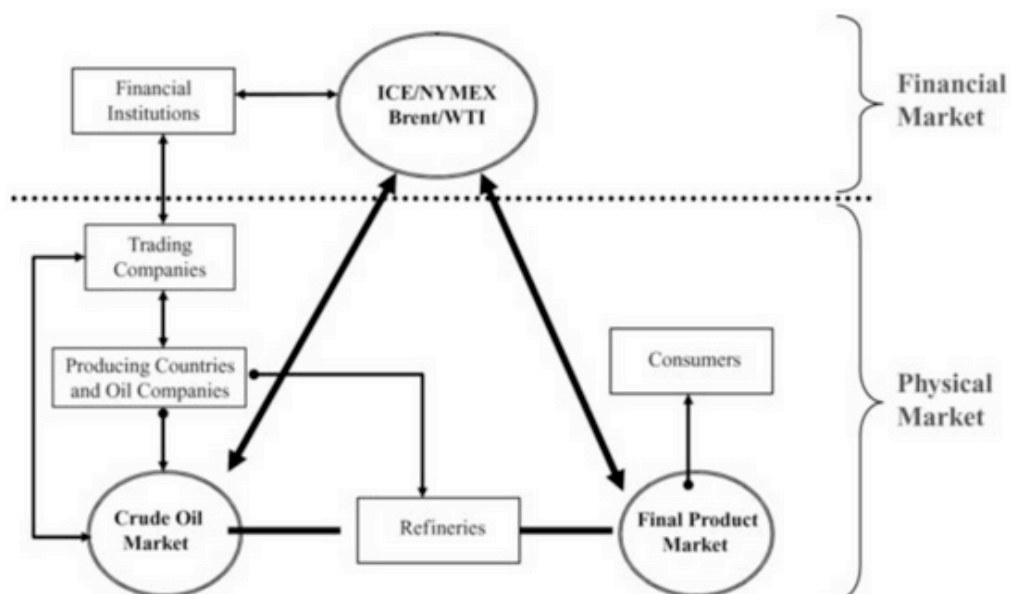
Figure 3 **CRUDE OIL VALUE CHAIN**



(Codoni, 1985)

The international oil market consists of many different sectors and economic actors that operate in multiple markets. There are producers, consumers, traders, hedgers, speculators, investors, policymakers and interest organizations to name a few as shown in figure 4.

Figure 4 **OVERVIEW OF THE OIL MARKET**



(Carollo, 2011)

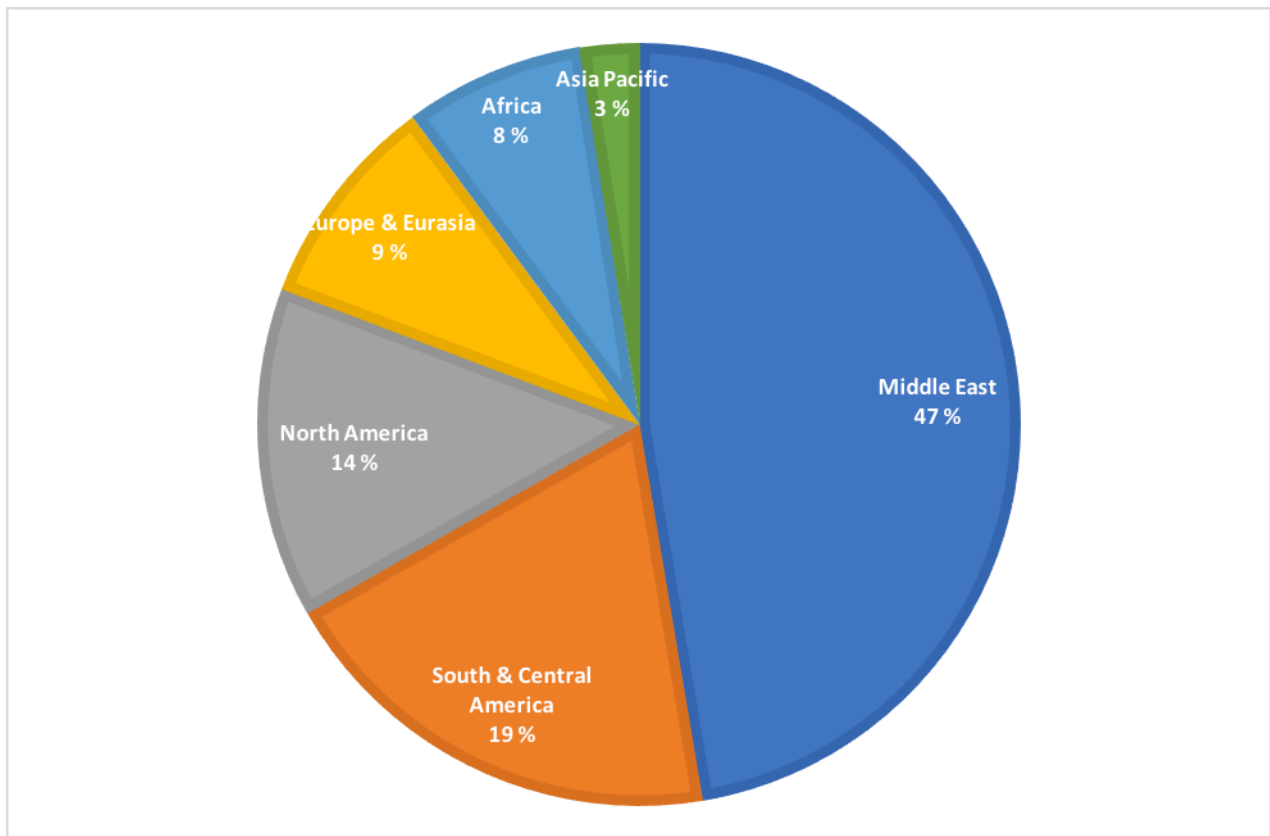
The exchange takes place on commodity exchanges, as options, futures or physical delivery of the crude oil. Given the nature of oil and the logistics, spot cargos with immediate delivery is not very common and a more used way is to link the pricing of an oil cargo to the time of loading the asset (Fattouh, 2011). The most important exchanges are the New York Mercantile Exchange (NYMEX) and Tokyo Commodity Exchange (TOCOM).

#### 2.4.1. Reserves

Looking at figure 5 we get an overview of how the distribution of proven oil reserves in 2015 was. Proven reserves can be defined as “an estimated quantity of all hydrocarbons statistically defined as crude oil or natural gas, which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Reservoirs are considered proven if economic productivity is supported by either actual production or conclusive formation testing.” (OPEC, 2017)

In 2015, the Middle East had 47 percent of the proven global oil reserves. Followed by South and Central America and North America.

FIGURE 5 PROVED RESERVES IN 2015 IN THOUSAND MILLION BARRELS



Authors own model with data retrieved from Oil & Gas (2016).

#### 2.4.2. Shale Oil revolution

Shale oil have been known as a potential to oil since the 10<sup>th</sup> century, but did not receive much attention before the last decades. There was a lack in technology so extracting the oil was not efficient. In addition, historically the oil prices were too low to make the investments beneficial, so it did not receive much attention before oil prices increased.

Shale oil consist of sedimentary layers of tightly packed rocks. In 1981, George P. Mitchell started to drill in the Barnett Shale, and over the next 20 years developed an efficient drilling method called fracking, which made it cheaper to produce shale oil. Lemons (2014)

Since then, shale oil has received much attention as well as investments, and at least 137 shale fields in 42 countries have now been discovered. Around 67 percent of the shale reserves are



located in six countries, namely: the US, Argentina, Australia, China, Libya and Russia. Among these countries, only Libya is an OPEC member (Lemons, 2014). The United States have been a forefront runner in the shale oil development. From 2013 to 2015, the North American shale oil production grew by approximately 1.5 million bbl/d per year (Wei, 2017).

In 2007, the EIA forecasted that the oil production in the US would be approximately constant to 2030, but we have actually seen levels much higher. Production levels have increased about 80 percent from 2008 to 2015 (Joskow, 2015). The developments in the shale industry had not been anticipated by the world market, and came as a surprise to most. It had long been known that there were large reserves, but not that it would be produced in large scale. The shale industry has seen huge technological innovations especially in hydraulic fracturing horizontal drilling, geological visualization and computation (Joskow, 2015). The IEA projects that global shale oil will amount to 8 million barrels of oil per day by 2040. This increase is according to Lemons (2014) the same as adding another US producer into the global supply. Traditionally having had high break-even prices, some fields are now raging down at the \$40 mark.

## 2.5. Oil Petroleum Exporting Countries – OPEC

### 2.5.1. OPEC objectives

OPEC is an abbreviate for “The Organization of the Petroleum Exporting Countries” and is an intergovernmental organization. It was founded in September 1960 and initially included Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. Today there are thirteen member countries including, Qatar, Indonesia, Libya, The United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon and Angola.

OPEC’s main objective is

*“To coordinate and unify petroleum policies among Member Countries, in order to secure fair and stable prices for petroleum producers; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on capital to those investing in the industry”* (OPEC 2017, para 1).

OPEC want to keep prices stable and at a good level for their members as well as lower the price volatility and adjust world supply in response to shortages in the world market (Amadeo, 2016).

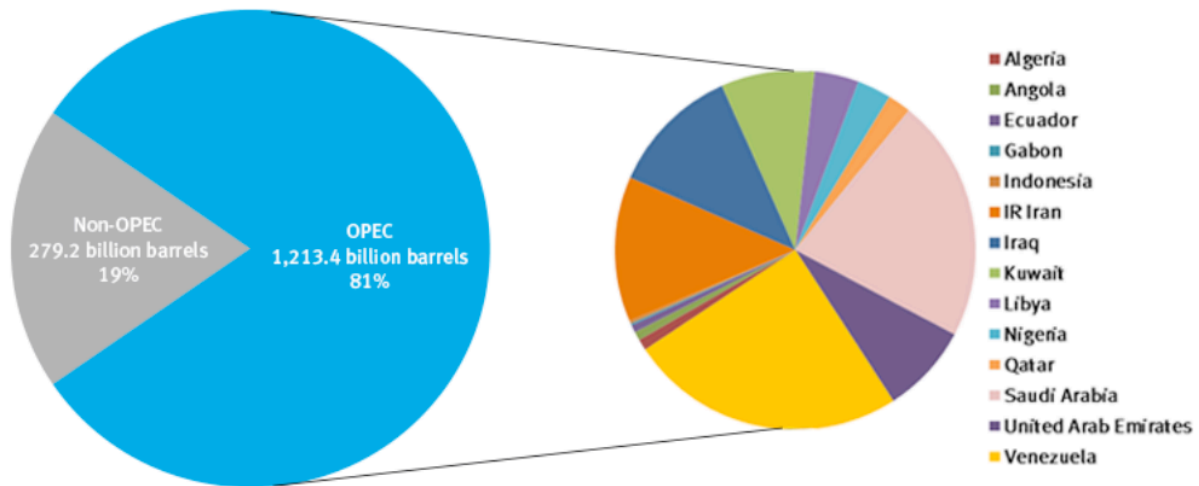
Twice a year, the Ministers of Energy and hydrocarbon affairs meet to discuss the status of the oil market and appropriate actions forward. In addition to these meetings, the members hold various meetings on topics of interest where they have committee experts etc.

When OPEC was established, the world oil market was dominated by large multinational oil companies, which were known by the name “seven sisters”. When established, oil production was rising, but prices were falling which in turn affected oil revenues significantly. The organization was established in an attempt to coordinate and secure petroleum policies for the members (Bhattacharyya, 2011). OPEC acted much as a trade union in the 1960s, were one of their main objectives was to protect their national interests in the production and exportation of oil and to prevent falling income to their member countries (Skeet, 1988).

OPEC had a fixed reference price for oil in the beginning, but switched to a system where they now set production targets for their member countries. (Till, 2015).

Figure 6 shows OPECs share of world crude oil reserves in 2015, where OPEC had 81 percent of the proven reserves. To be able to keep prices stable, it is important that they have reserves to be able to respond quickly to the market. I will discuss this more in detail in later chapters.

Figure 6 OPEC SHARE OF WORLD CRUDE OIL RESERVES 2015



(OPEC statistical bulletin, 2016)

### 2.5.2. The oil market before the establishment of OPEC

The years from 1859 to 1870 was influenced by a rush of extracting and oil production with very low recovery rates, raging down at the 5 percent area. Prices were under massive fluctuations and the era was far from stable. Following the 1870s, the oil market was dominated by one big player, John D, Rockefeller who started the Standard Oil Company in 1870. The establishment of this company changed the rules of the oil industry and marks a new era in the oil history. Through active mergers, the company gained control of 90-95 percent of the oil refineries in the US. Having such a large portion of the world oil market, the firm could influence the oil prices, demand and supply through their market power (Bhattacharyya, 2011).

From 1911 to 1928 oil was becoming the most used fuel in the world, surpassing coal which had been the leading source of fuel for several years (Bhattacharyya, 2011). The first world war as well as the rise of the automobile industry raised the demand for fuel and governments around the world started to look at oil as a strategic asset. The British government was the first to enter the oil market when they acquired 51 percent of the Anglo-Persian Oil Company

(which later was known as the British Petroleum).

The Achnacarry Agreement was made and signed in 1928 by three of the leading oil companies at the time. was an attempt to restrict petroleum production after prices fell due to oversupply in the market. stabilize the market, minimize competition and organize the market on an “as is” principal. time (Bhattacharyya, 2011).

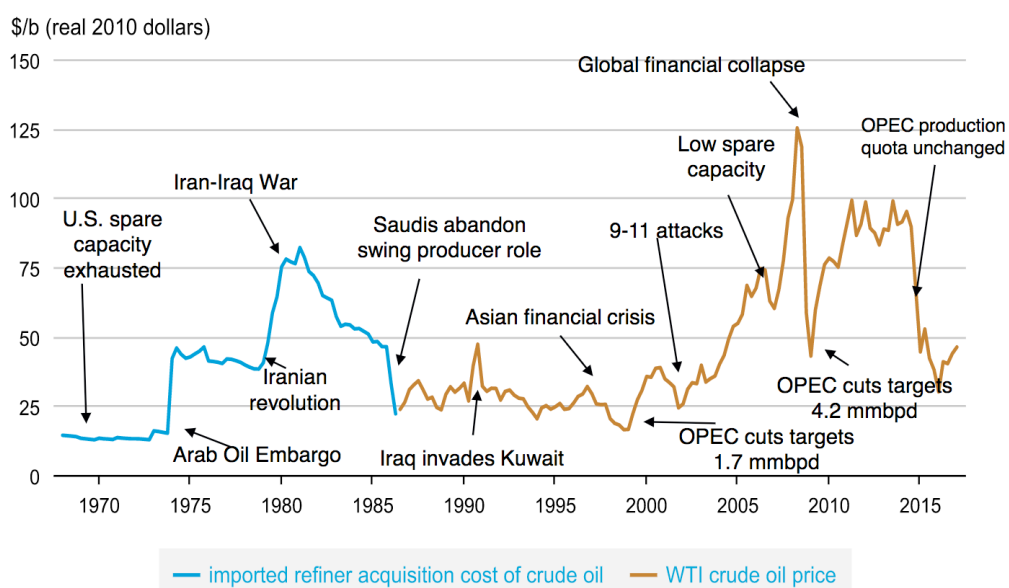
By 1890, 88 percent of the crude oil value chain was controlled by Standard Oil. In 1904, they controlled 91 percent of the US production and there was little competition in the oil market.

In 1911, the Standard Oil Company was ordered by the supreme court to breakup due antitrust violations. Standard Oil was accused of monopoly and aggressive underpricing to get rid of competition (Folsom,1988).

In July 1911, Standard oil announced its plan to dissolve and decentralize into several smaller companies. The breakup of the company resulted in 34 new companies, many of which are big players in the oil market today like ESSO, ExxonMobile and BP.

### 2.5.3. Oil Prices and OPECs actions

Figure 7 HISTORICAL OIL PRICES



(IEA, 2017).

Many oil producing nations experienced that they had little power and no impact on the low oil prices in the 1960s, much due to the big players in the world oil market at the time, the seven sisters.

In 1967, oil was the leading energy source in the world and OPEC was established to stabilize the market. In the beginning, however they had little impact of the oil price as the international oil market was still under control of the Western transnational oil companies. The organization focused mainly on changing the tax system, controlling production levels and moving towards nationalizing the organization. In the beginning, the organization had very limited pricing power, and consequently one of the few impact channels they had were to change the tax system in a way that benefited the member countries. This was done by increasing the tax reference price, royalties and banning marketing allowance. OPEC set a production target level in 1965, but this only lasted until 1967. In 1968, they signed a manifesto which encouraged the members to nationalize the oil companies, to have reserves for the future (Bhattacharyya, 2011). At the time, the oil producing countries were depending in the big international oil companies to sell their oil.

Looking at figure 7, The rapid increase in the oil price we saw in the beginning and middle of the 1970s was a result of a tightening in the supply. In October 1973, the Yom Kippur war expanded between Israel on the one side and Egypt and Syria on the other. With the United States support for Israel, the Arab producers responded to this by enforced an oil embargo against the United States, South Africa, Holland and Portugal. At the same time, OPEC decided to cut their oil production by 5 million barrels per day, a 25 percent decline (Deman, 2015).

The oil embargo in 1973, the Iranian revolution in 1978 and the Iran and Iraq war in 1980 sent prices up the roof (Deman, 2015). Due for amongst other a fear of import difficulties and lower supply, oil demand was high, sending prices up the roof. By the end of 1974, prices had risen from US\$3 in 1973 to US\$12 per barrel. (Gately, 1986). OPEC continued to push their members for nationalizing their oil, but they were still dependent on international oil companies to explore, sell and deliver the oil to the world market.

Due to the oil shock in 1973, OPEC policies in the following periods were colored by this, and one of their main objectives was at demand stabilization as well as having a moderate price increase in oil. There were some disagreements amongst OPEC members as to how they should price crude oil. For a short period of time, there were two official prices – one for Arab producers and one for the other OPEC members. This did not last however, but led to OPEC establishing a committee for constructing a long-term strategy for OPEC (Amadeo, 2006).

The Iranian revolution in the end of the 1970s, followed by the war between Iran and Iraq led to a stop in oil production in these countries. Before the war, Iraqi production was 3.5 million barrels per day, and by the last month of 1980, they were producing 500 thousand barrels per day. The drastic reduction of oil production plunged the international oil market into a panic. This again led to a rise in the oil prices, to US \$34 in 1981 as seen in figure 7. There was now a huge difference in oil prices in the spot market and the official OPEC prices, and the members wanted to sell in the spot market to get the higher prices. As much as 25 percent of OPEC oil was in the period sold in the spot market and some countries also canceled long term contracts to benefit from the higher spot prices (Alhajji & Huettner, 2000c).

Having now experienced two oil crises, oil importing countries were now looking for alternatives to oil, understanding how volatile they were if another crisis were to hit. OPEC started to lose their market share, and non-OPEC oil started to get a bigger share of the global oil trade. In a response to this, OPEC fixed their price to \$34 per barrel in an attempt to gain market shares. An increase in non-OPEC production as well as declining world demand resulted in cuts in OPECs production in first half of the 1980s, in an attempt to defend their prices and to achieve the set price, they set a goal of reducing production by ten percent in 1981 (Bhattachatyaa, 2011).

In 1982 OPEC set their first production target, but there were much disagreements as to what the target should be. At the time, the world was in a recession and a debt crisis. Saudi Arabia entered the role as a swing producer and had to reduce their production. From having a market share of 50 percent in 1973, OPEC saw a market share of close to 20 percent in 1986. By 1985 OPEC crude oil production had fallen 14 MMbbl/d from 1979. Saudi Arabia had taken much of the hit, with production falling from around 10 MMbbl/d in 1980 to

under 4 MMbbl/d in 1985 (Deman, 2015). A price war started when OPEC members decided to regain market share. Saudi Arabia in turn, decided to not support the production cuts any more, and the third oil shock hit the world. By July 1986, prices had fallen to \$7 per barrel.

From August 1985 to the middle of 1986, OPEC raised their production by around 25 percent. Saudi Arabia was the member who started the increase in production levels, in an attempt to regain much of their lost market share. An oversupply in the market led to a dramatic decrease in the price of oil, a decline of more than 50 percent in the first 2 quarters of 1986.

After the first two oil crises, the world saw that they were too dependent on oil and started to look for alternatives. This led to a reduction in oil demand in the 80s, where we for the first time saw that oil only accounted for slightly under 40 percent of total energy demand. The world oil demand grew quite rapidly from 1973 to 1974. From 1973 to 1978 the growth was slower and by 1979 to 1983 demand fell by 10 percent (Gately, 1986).

In 1990 oil prices spiked as seen in figure 7 due to oil shortage and uncertainty towards the Iraqi invasion amongst others. After the Gulf War, oil prices declined and in 1994 oil price adjusted for inflation hit its lowest since 1973 (Williams, 2011). From the low levels, demand started to rise, and so did oil prices before the Asian Economic crisis hit and prices fell in 1998. OPEC adjusted their production and seems to have controlled the market. The price of oil was between \$15 and \$20 much due to OPEC's production targets, and we could have seen lower prices had it not been for this. OPEC's market share increased, but nevertheless, the non-OPEC countries were the main suppliers to the world market. The Asian economy had been through a rise in demand, but in 1998 the Asian oil consumption saw its first decline since 1982, at the same time as there was an oversupply in the market (Williams, 2011).

After hitting a low in the 1990s, prices of oil started to rise in the 2000s and from 2002 the global economy began to enter into a full recovery period. In the beginning, the spare capacity was limited, and thus was OPEC's regulating powers. In the 2000s we saw the American invasion of Iraq, as well as high and increasing demand from China. Also, the

Nigerian oil industry was anything but stable. Prices of oil rose higher than forecasted by OPEC. The global GDP growth rate rose from 2001, and continued to stay high. This caused demand for oil to rise, and led it to the all time high of close to \$150 per barrel in 2008. In the same year, the financial crisis hit the world market, and in the end of 2008, prices dropped to \$40 per barrel. Indonesia left OPEC in May of 2008 as they were unable to meet its production quota, although this was a choice of Indonesia and not the organization.

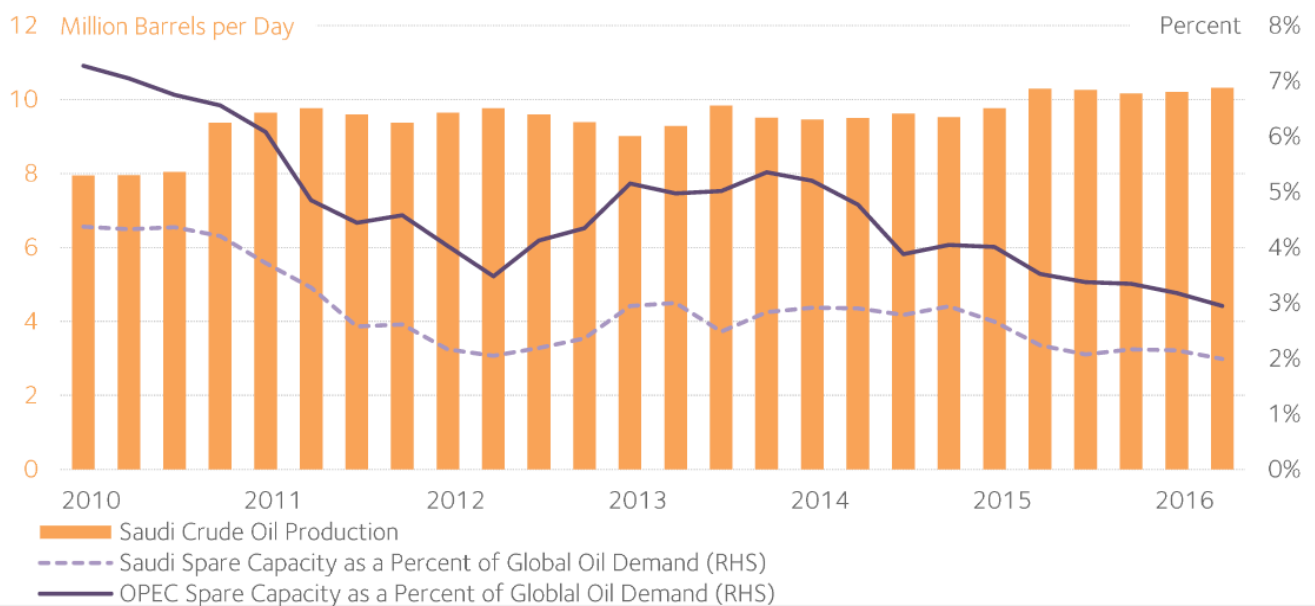
In 2014, the oil market again experienced a huge drop in prices and ended up at \$36 sending the oil sector into a crisis. The last couple of years is referred to as the oil glut in literature and involve a situation where we have seen lower demand from China than expected, and a boom in the shale production.. I will come back to the recent price plunge in later chapters.

#### 2.5.3.1. Saudi Arabia

Saudi Arabia is treated as the dominant producer in many studies and literature, due to their predominant position in the world oil market (Bremond, Hache & Mignon, 2012). Saudi Arabia produce more than one tenth of the world oil output and owns more than one quarter of the proven reserves (Nakov & Nuno, 2013). they have a spare production capacity of over 2 million barrels per day, setting them in a position where they have major impact of oil supply to the world (Nakov & Nuno, 2013). Some scholars actually claim that Saudi Arabia is so dominant that they are OPEC (Mabro, 1975).



Figure 8 SAUDI ARABIA SPARE CAPACITY AS % OF WORLD LIQUID FUELS CONSUMPTION



(Securing America's future energy, (2016))

Looking at the figure 8, we see the strategic importance of Saudi Arabia's influence and productions levels due to the large market share. Also, they have large easily reachable and low cost reserves. Saudi Arabia was an important driving source in the creation of OPEC, and has since the establishment of OPEC been one of the most active members (Alhajji & Huettner, 2000).

It has for many years ruled as one of the biggest oil nations in the world and about 90 percent of their government revenue is derived from oil (Kibsi et al., 2015). Most of Saudi Arabia's income comes from the petroleum sector. As much as 95 percent of the export and 70 percent of the government revenue is from this sector, and therefore several scholars point out their political dependence and agenda on oil prices (Kibsi, 2015)

### 3. Theory and literature review

The five standard characteristics of a perfectly competitive industry according to Simpson (2010). are:

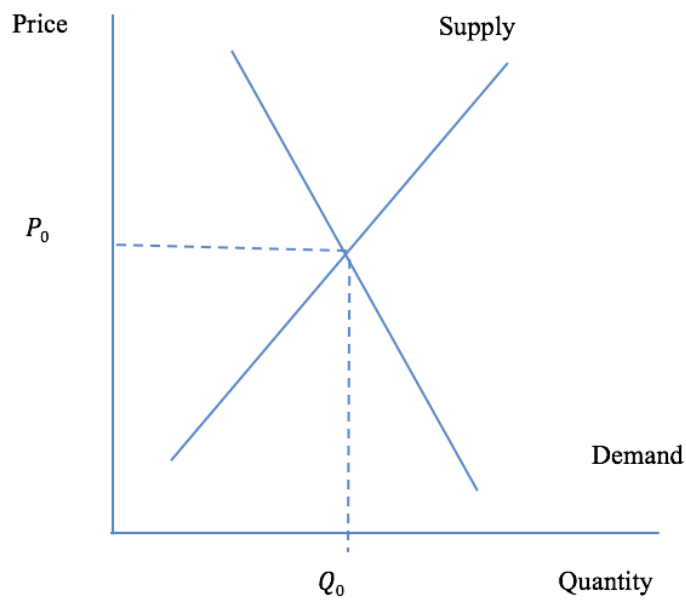
1. Insignificant barriers to entry and exit
2. A large number of small producers
3. Homogenous products
4. Perfect information
5. All firms are price takers

Under perfect competition, the firm must accept the price determined in the market. The firm is a price taker and can produce as much or as little as it likes without affecting the market price. Each firm must match the price offered by its competitors because the products are identical. Otherwise, consumers will shift their purchases to another firm. The price in the industry as a whole, which then is comprised of all the individual firms and consumers, is determined by supply and demand. For a perfectly competitive firm, marginal revenue (MR) is always equal to the market price.

The long-run market equilibrium may differ from the short-run market equilibrium because the number of firms may change. Firms enter or exit the industry based on profits earned in the industry. If short-run profits are greater than zero, new firms are motivated to enter the industry. Alternatively, short-run losses encourage existing firms to exit.

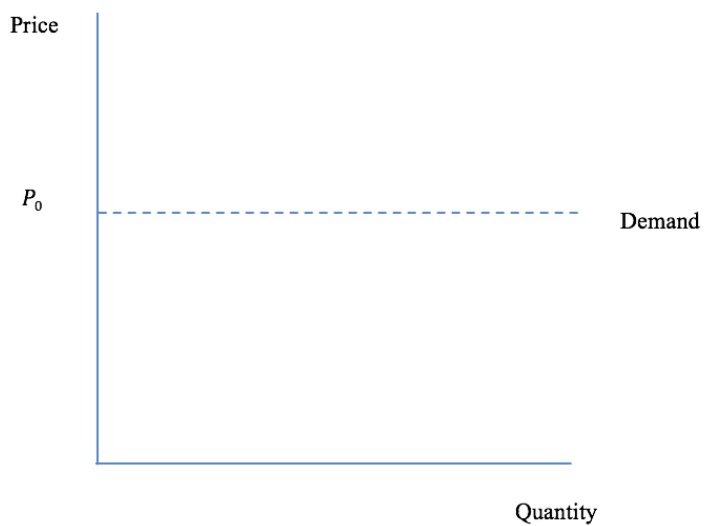
If firms earn high profits in an industry, then new firms enter, forcing the market price down as the short-run market supply curve shifts out.

Figure 9 **DEMAND CURVE IN A PERFECTLY COMPETITIVE MARKET**



(Authors own model)

Figure 10 **DEMAND CURVE FOR A SINGLE FIRM IN A COMPETITIVE MARKET**



(Authors own model)

### 3.1. Demand

Consistent with consumer theory, the demand of a good is a function of its price and income, which can vary depending on which sector we are looking at (Varian, 1992). Formally, it can be represented as:

$$\text{Demand} = D(P, Y)$$

Where P represent the price, and Y represent the income. Consumers are all utility maximizers. They want to get as much utility as possible for as little cost as possible.

Basic microeconomic models about supply and demand is one of the most used models for understanding oil price (Dees, Karadeloglou, Kaufmann & Sanchez, 2007). In the long run, the demand and the supply should determine the price of oil. While true for many commodities, the complexity of the oil market has proven this model difficult. Many different factors influence both the supply and the demand of oil, and many of them are hard and sometimes impossible to predict. This being political, environmental disasters, geopolitical, wartime or technological improvements. If we were to set up a supply and demand curve for oil we would however see that the demand curve for oil is downward sloping, showing us that a rise in prices, *ceteris paribus*, it will decrease the total quantity demanded in the market. On the other hand, the supply curve is upward sloping telling us that a rise in the price of oil will increase the total amount supplied in the market.

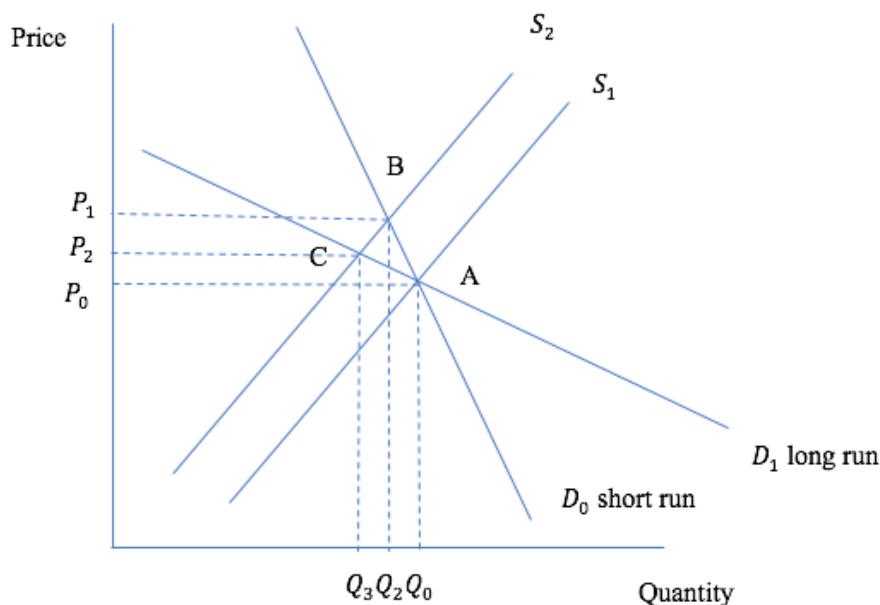
According to studies, short term demand elasticities of oil is inelastic, but in the long-term elastic. This tells us how quickly the quantity demanded responds to price. If demand is very elastic, then changes in price would cause large changes in the demanded quantity. Inelastic demand implies little changes in demanded quantity as prices changes. (Behar & Ritz, 2016). The production process of oil is fairly complex matter, making it difficult to adjust output levels to changes in prices on short term. At the same time, it is difficult for consumers to turn around quickly and change their consumption in the short run, leaving the oil market with relatively vertical demand and supply curves.

GDP is often used as a reference to income levels. An increase in GDP levels impact the

demand for oil, and studies show that GDP increase in non-OECD countries affect oil demand more than non-OECD. Emerging markets have also been known to be more dependent on oil intensive sources than more developed countries (Fournier, Koske, Wanner & Zipperer, 2013).

Figure 11 shows how changes in demand effect prices over a period of time. When the supply of oil decreases from  $S_1$  to  $S_2$ , prices rise due to the decreased supply, and the quantity of oil demanded moves along the demand curve  $D_1$  from point A to point B. The demand for oil is inelastic because either people have no other alternative to this oil, or the alternative is more costly. However, as prices rise over time, technological improvements are developed, alternative energy sources become less expensive, and people have time to adopt energy saving technologies. In the long run, the demand for oil becomes more elastic  $D_2$  because at the higher price levels, people have a choice to either consume the oil or switch to an alternative source. Therefore, the oil price and quantity demanded are established in the long run at point C.

Figure 11 DEMAND CHANGE EFFECTS ON PRICE



(Authors model based on Bhattacharyya, 2011)

### 3.2. Supply

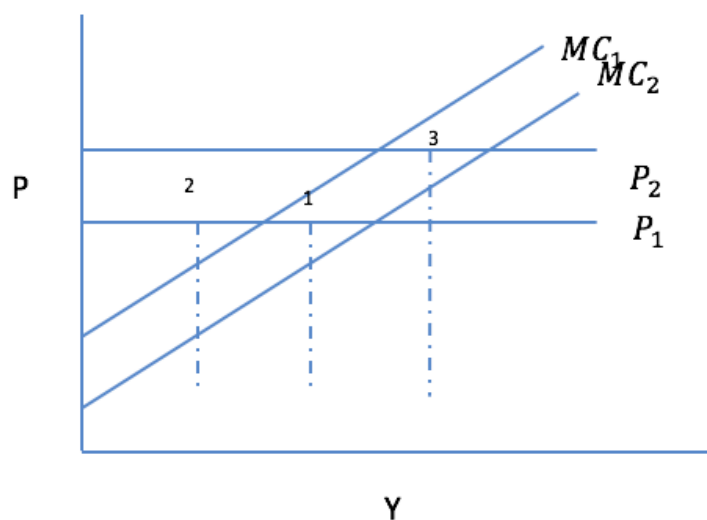
The supply curve shows the relationship between quantities produced and the price. Any profit-maximizing firm chooses inputs and outputs to maximize its economic profits.

Microeconomic theory suggests that if quantity increase, the marginal costs will also increase. The cost function is assumed to be strictly convex in  $y_1$ , meaning that the marginal cost would be upward sloping.

Assuming a constant price, figure 12 demonstrates a shift in marginal costs, and how it affects production levels. Starting at point 1, if the price of production input capital or labor rise, we will move from  $MC_1$  to  $MC_2$ , and then end up producing at lower levels and thus less supply, at point 2. Assuming an increase in price, we will see the opposite, assuming no change in marginal costs (MC), producers will shift to the right and supply will increase, point 3 in figure x. A formal representation of supply can be represented by (where P is price and X is input):

$$\text{Supply} = f(P, X)$$

Figure 12 **SHIFT IN COST ON PRODUCTION LEVELS**



(Authors model based on Bhattacharyya, 2011)

### 3.3. Mechanisms of price formation

As is true in any other commodity that is storable demand and supply determine the long run prices of crude oil. At the same time, there are many other factors to include when determining and understanding oil price fluctuations.

According to Hamilton (2009), there are four groups of factors that contribute to changes in oil price. Changes to demand due to economic activity represented by GDP. Anticipation of supply and geopolitical affairs. Changes in objectives and strategies of oil producers and speculation and financial market participation.

### 3.4. Imperfect market competition

An imperfect market is a market situation where the perfect market situation is not satisfied. It A monopoly exists when there is only one supplier of a good, with no close substitutes, in a given geographic region (Arnold, 2001).

Oligopolistic markets are often characterized by a group of firms employing strict guidelines for its members, known as cartels. One of the most famous cited organization when it comes to cartels are OPEC, which will be presented in the next chapter.

### 3.5. OPEC

Believed by many to be a price setter, and others to be of limited importance in influencing the price levels in the world market (Golombek Alfonso & Lin Ma, 2015).

OPEC is often described as a profit-maximizing cartel and is often synonymous with cartel or monopoly power in literature (Alhajji & Huettner, 2000). OPEC itself does not identify itself as a cartel and scholars disagree as to where her or not they are trying to drive prices higher or it they are stabilizing the oil market (Marcel & Mitchell, 2006).

Since OPEC plays such an important role in the oil market, and many believe they are a cartel

most of the economic models and price forecasting tools of oil have been developed for a cartel that seeks to maximize their profit (Alhajji, 2000); (Fattouh & Mahadeva, 2013). Others find it important to treat OPEC as an organization of several individual players and not one unit and therefore, while others split the OPEC members into three different groups; hard core, the price pushers, and the expansionist fringe (Eckbo, 1976).

Bremond et al. (2012) found in their study that OPEC mainly acts as a price taker and that OPEC can be viewed as a split organization in the sense that some parts of the organization runs as a cartel on behalf of the other half.

Others again view OPEC as the more extreme version of a monopolist.

Hansen & Lindholdt (2008) used monthly data from 1973 to 2001 to check OPECs market power using short and long run elasticities. They found that economic growth influence the oil demand more than the price levels. Their results imply that the producers outside of OPEC can be view as competitive producers, where the oil price is given and were they are profit maximizing. Also, they found that OPEC members were not price takers. They found that OPEC could not as a whole organization be characterized as a dominant producer because it does not operate on the elastic part of its long-run demand curve, as they would have done had they been a profit maximizing dominant producer (Hansen & Lindholdt, 2008). In sum, they found that OPEC could not be viewed as a profit maximizing dominant producer, but that they clearly have affected market prices.

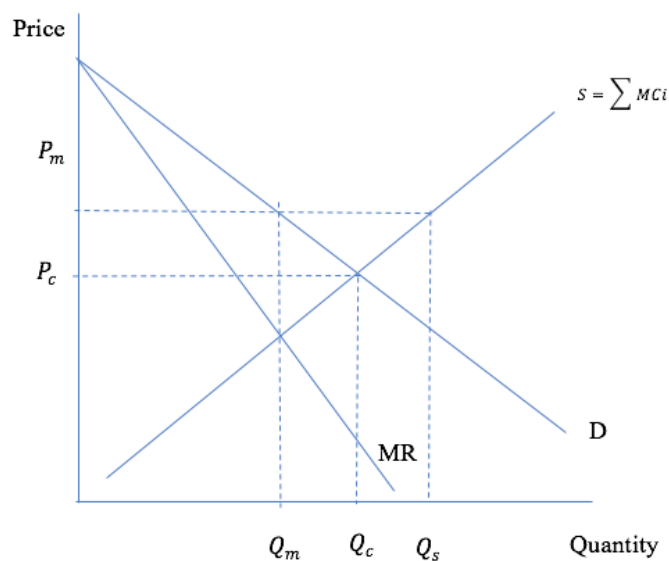
### 3.6. The Cartel model

A cartel occurs when an organization is established in order to control the market by fixing prices and limiting supply though setting production quotas Bhattacharyya (2011). The objective of having a cartel is to generate higher profit levels for the members through reducing competition. If members decide on a given monopoly price, which is represented by  $P_m$  in figure 13, they will also agree on reducing supply to levels where marginal revenue equals marginal cost. By doing this, every member will receive higher prices for their supply (Bhattacharyya, 2011) In figure 13, the free market price in represented by  $P_c$  and free market



quantity by  $Q_c$ . As long as all members benefit more from this agreement than they would in a free or competitive market, they will oblige. The problem or challenge with this model however is that the individual members will have an incentive to rise production to maximize its production. If this happens, there will be an oversupply in the market at  $Q_s$ , and we would see a decline in prices to the competitive price levels or below (Bhattacharyya, 2011).

Figure 13 **CARTEL WITH A MONOPOLY PRICE**



Authors own model based on Bhattacharyya (2011)

Bhattacharyya (2011) argue that in real life, Cartels rarely are successful as there are a number of factors that need to be fulfilled to be successful. Amongst others, the member of the cartel each need to benefit from the actions, there need to be group discipline and a way of detecting cheating. In addition, a small group is easier to control than a larger group, and having a cartel with homogenous members with inelastic demand is more likely to succeed

Alhajji & Huettner (2000) also have found some characteristics that a successful cartel inhabits. These are listed below and will be discussed more in depth in later chapters.

- The cartel would divide the market by having a quota system

- Monitor the system
- Punish cheaters
- Enforce cartel authority
- Have cash and buffer stocks to prevent too high prices which in turn would lead customers to substitute
- A large market share

### 3.7. The dominant firm

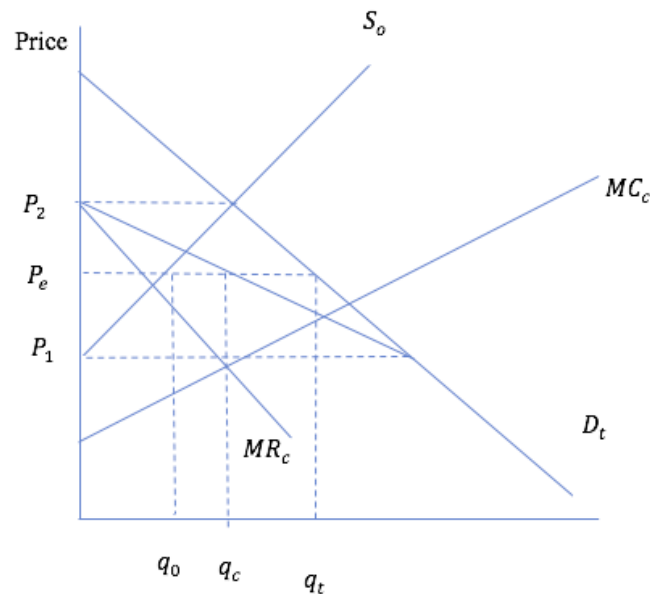
The dominant firm model is also often cited in economic literature in trying to explain the behavior of OPEC (Alhajji & Huettner, 2000). The theory claims that the dominant firm is controlling the oil price, but do not have any control of the competitors output. Different scholars have different versions of who the dominant firm is, some points to OPEC as the dominant, and others where Saudi Arabia plays the role and others again where OPEC core countries (Saudi-Arabia, Kuwait, UAE and Qatar) are the dominant ones. Many scholars believe that Saudi Arabia are the dominant part in OPEC. Others on the other hand, found no support of this view in their studies (Smith, 2005). As the dominant producer, Saudi Arabia would set its output in anticipation of the reaction of the competing fringe (both OPEC and non-OPEC) and maximizes its profits based on the residual demand (Almoguera, Douglas & Herrera, 2011). Alhajji & Huettner (2000) also found in their study that due to its market power, and its geopolitical relationships, Saudi is the dominant member in OPEC where they use this power to pressure the rest of OPEC to set production levels in align with their strategic goals and price levels.

Those believing OPEC is a dominant firm, thinks of it as a cartel and that the members have set goals and together set the price levels. The competing firms are called the fringe and consist of non-OPEC countries. OPEC set price where marginal revenue is equal to marginal cost, and the competing fringe will then supply at a level where price is equal to marginal cost and OPEC will supply the remaining.

Bhattacharyya (2011) argues that having a dominant firm within the cartel is needed in order to keep the market power as well as to stop members from cheating. The leader must have a significant market share, high flexibility in regards to capacity, less sensitive to market

changes and low financing requirements (Bhattacharyya, 2011).

Figure 14. CARTEL WITH A LEADER



Authors own model based on Bhattacharyya (2011)

### 3.8. Limit Pricing Model

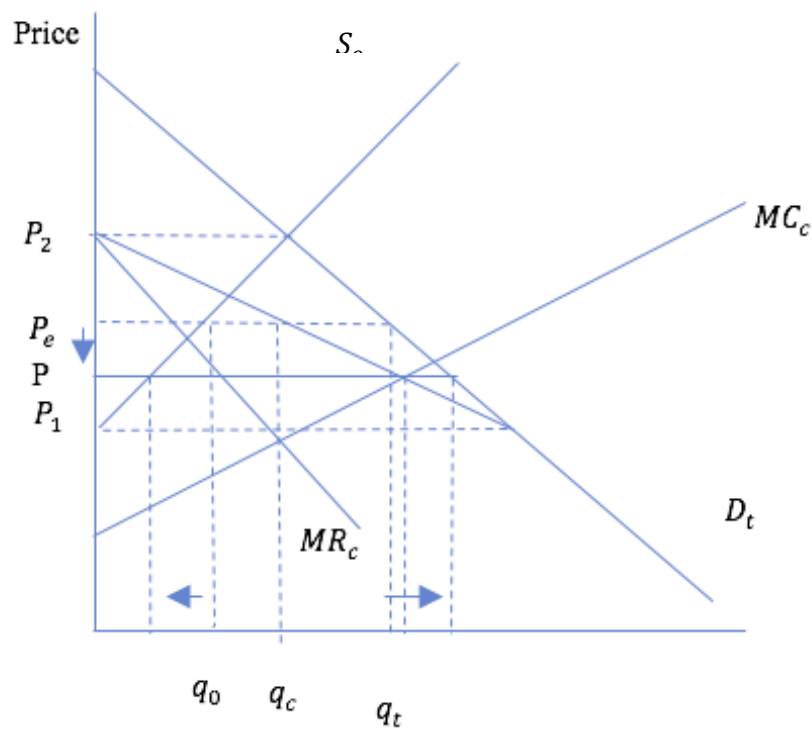
This model can be used to understand and examine changes in demand faced by the Cartel. Competition may arise from substitutes as well as other suppliers which in turn will affect the supply and demand curves. Looking at figure 15,  $MC_c$  represent the supply curve of the cartel,  $S_0$  represent the non-cartel supply curve. At  $p_1$  we have a situation where the cartel faces total demand. At  $P_2$ , the non-cartel would be able to supply the total demand, and the cartel none. Having this information, the cartel demand curve is found. The cartel set their marginal revenue equal to their marginal costs to profit maximize and end up at quantity  $q_c$  and price  $P_e$ . The non-cartel producers would then produce at  $q_0$  where  $q_t = q_0 + q_c$  (Bhattacharyya, 2011).

Facing competition, the cartel have two options. Declare either a price war or a more defensive line where the cartel protects their resources and let the non-cartel competitor operate in the market. The price strategy, also known as the squeeze strategy means that the cartel will try to squeeze the competitors out of the market. Benefiting from cost advantages,

they can let the prices drop, and see competitors at higher cost levels lose their competitiveness and loose grounds as the cartel gains their market share. We will also see an increase in the overall supply if the cartel chooses the price war or squeeze strategy.

Choosing a defensive strategy, the cartel can decide to set prices below their threshold level to prevent entry from competitors. Even though this is not profit maximizing for the cartel, it discourages others to enter the market, as prices are too low. Another way of preventing too loose market share to no-cartels, they can according to Bhattacharyya (2011) choose the equilibrium price level  $P_e$ , and threaten with a price war to scare others from entering.

Figure 15 LIMIT PRICING MODEL



*Authors own model based on Bhattacharyya (2011)*

### 3.9. Target Revenue model

Developed by Ezzati (1976), and implies that OPEC base their decision on their national budget requirements (Bhattacharyya, 2011). If their production targets are below level required to meet their investments, they are obliged to cheat and produce higher levels. If it is the other way around, the country might be willing to reduce their production. His theory suggest that only the members that are marginal in oil resources would have incentives to cheat. The richer members of the cartel might not want to leave oil in the ground, as the return might not be profitable, where smaller members may want to postpone production.

According to the strict version of the model, OPEC is not a profit maximizer, but that OPEC members vary their production based upon their short-term budgetary needs (Alhajji & Huettner, 2000). OPEC members will first find their budgetary needs, and then decide their output levels, based on the pricing in the market (Alhajji & Huettner, 2000c).

## 4. Analysis

### 4.1. The Origin of a price shock

Looking at the historical price levels of oil, there can be made some distinctions as to how the shocks happened. Supply and demand shocks have different results and degree of “damage”, as to how they affect the economy. Oil price shock can be defined as an unexpected change in the level of oil prices, caused by some external factors. (Chuku, 2012). Looking at historical price levels of oil, there can be made some distinction as to how the shocks occur, the nature and the origin of the shock. Supply and demand shock have different origins and impact on the global oil market (Peersman & Robays, 2012). Barsky & Killian (2004) have studied historical price shocks, and have grouped them into three categories.

1. Oil supply shock
2. Aggregate demand shocks
3. Precautionary demand shocks

Peersman and Robays (2012) have made the same distinctions, dividing them into: oil supply disruptions, growth in demand driven by economic activity and an increase in demand due to other reasons (speculations in price, anxiety of low availability etc.).

Oil price shocks are also different in how long they last, transitory or permanent. Transitory or short term shocks have a shorter time span and generate variations along the long-term trend, whereas permanent change the long-term trend (Hamilton, 2003).

Identifying the reason for the price shock of the oil prices may help us in understanding OPEC’s role. Understanding where the price decline in 2014 has its origin is important in understanding OPECs power. In the following subchapters, I will present different types of oil shocks before we take a closer look at the price decline of 2014 and how it happened.

#### 4.1.1. Supply shocks

Having a supply shocks means that there is a shock to the current availability of oil to the market (Killian, 2008). Analysts forecast the level of crude oil in the market, looking at inventory levels, geopolitical issues and advanced mathematical models.

Peersman & Robays (2012) find in their studies that given a negative supply shocks, most of the net oil importers experience fall in economic output and an increase in inflation. Looking at the energy exporting countries on the other hand, they found a growth in the economic activity and no negative impacts on inflation. Güntner (2013) found in his study that negative supply shock had no significant effect on the stock markets when looking at developed countries and economies. Kilian (2008) identifies the oil price shocks presented in table 1 as supply shocks and their effect on economic activity in G7 countries.

**Table 1 SUPPLY SHOCKS AND ITS IMPACT**

<b>Year</b>	<b>Effect on economic activity in G7 countries</b>
1973 – 1974	No significant effect
1987 – 1990	Yes, lead to stagflation
1990 – 1991	Yes, lead to stagflation
2002 – 2003	No significant effect

Authors own table based on Kilian (2008).

#### 4.1.2. Oil demand shocks

Kilian (2009) finds that demand shocks is an important factor for explaining fluctuations in the oil price, but that it is difficult to quantify these types of shock. The expectation shift is often difficult to observe. Kilian (2009) found that demand shocks often stem from sudden changes in the expectation about the future availability in the oil supply levels. One example of this could be the military threat to Saudi Arabian oil fields in the last part of the 1990s which lead to a significantly rise in the temporary precautionary demand for oil, which in turn lead to fluctuations in the oil price.

Studies done by Peersman & Robays (2012) showed that demand shock resulted in a short run increase in the economic activity as well as higher inflation in all the countries they had in their sample. Kilian (2008) found that contrary to previous finding and beliefs, wars and revolution affects oil prices mostly through influence on precautionary demand for oil.

Caldara, Cavallo & Iacoviello (2016) found in their study that global demand shocks could explain around 35 percent of the historical fluctuations in oil prices. Killian (2009) found in his estimates that demand could account for 8 percent.

#### 4.2. Impacts of an oil shock

If the price of oil goes up, then petroleum products get more expensive. Having an inflation shock would increase the domestic price levels, if we assume that other prices are downward sticky. This would in turn lower demand and higher interest rates, which in the end would lead to lower output.

An unexpected increase in the price of oil would lead to a reduction in the purchasing power of households. Giving us a shift in the aggregate demand to the left.

Also, on the supply side, we would see that an increase in oil price levels would lead to more expensive raw material and higher capital expenses giving a supply shock to the left. We would have a situation where both income and production would fall.

Hamilton (1983) found in his studies that oil shocks would cause a recession in the economy. In his paper “All but one of the U.S. recessions since World War 2 have been preceded, typically with a lag of around three-fourths of a year, by a dramatic increase in the price of crude petroleum”. His core results, which have been cited by many scholars since, was that a rise in the oil price would be followed by a decline in the GDP.

#### 4.3. OPECs actions following the price plunge of 2014

In June of 2014, we saw a sharp decrease in oil prices. From June 2014 to January 2015, oil prices fell by about 50 percent. According to Baffes, Kose, Ohnsorge & Stocke (2015) the reasons for this came from both the supply and the demand side, but the supply side seems to have played a more prominent role. OPECs decision to maintain their production ceiling of 30 million bpd despite a glut in the market is also believed by Arezki and Blanchard (2014) to play a major role in the price decline, see figure 16.



Figure 16 BRENT CRUDE OIL PRICES JANUARY 2014- JANUARY 2016



(West, 2016)

OPEC have traditionally held the role of being a swing producer, but in the end of November 2014, OPEC had a meeting where they announced that they would follow a new strategy. They would focus on improving their market shares (Behar & Ritz, 2016). This is coherent with OPECs announcement to try to squeeze high cost production out of the market. According to the limit pricing model presented in the theory chapter, this could imply that they were choosing the squeeze strategy. In the long run, it would benefit OPEC to get rid of shale and competition. The limit pricing model tells us that choosing this strategy one would expect prices to drop and see competitors of higher cost lose their competitiveness at the same time as OPEC gain market share. Prices did drop, and many of the competitors fell under because of low oil prices.

The Saudi Arabian oil minister, which was also the leader in OPEC at the time said:

*“In a situation like this, it is difficult, if not impossible, for the kingdom or for OPEC to take any action that would reduce its market share and increase the shares of others...”*

(Anderson, 2014).

As the market expected OPEC to restrict oil production in November of 2014, prices may have stayed higher than they otherwise would, which is in line with Kilian's precautionary demand theory. When OPEC decided not to restrict their quotas, the expectations about the OPEC supply changed, and consequently, following the decision not to restrict the production quota, prices fell by 20 percent.

By May 2015 the price had somewhat recovered at \$65. When OPEC met in December 2015, they announced that they were still following the decision not to cut in their productions. Media have reported on an increase in disputes among OPEC members following this and after what seems to be much disagreement among OPEC members; they announced a new strategy in December 2016. From January 1<sup>st</sup> of 2017, they would cut production levels and enter the role as a swing producer.

To get a better understanding, it is beneficial to understand what caused the price decline in 2014 and if it came from a supply or demand side. In the next subchapter, I will present an overview of the recent decline.

#### 4.3.1. The price plunge in 2014

The sharp decline in oil prices in 2014 came after years of higher than expected supply from non-OPEC as well as more than expected from the OPEC countries Iraq, Libya and Saudi Arabia. We saw lower than expected demand from Europe and Asia, political uncertainties, appreciation of US dollar as well as changes in OPEC objectives. All these factors seem to have played a major part in the oil price plunge, especially higher supply seems to have played an important role (Baffes et al., 2015).

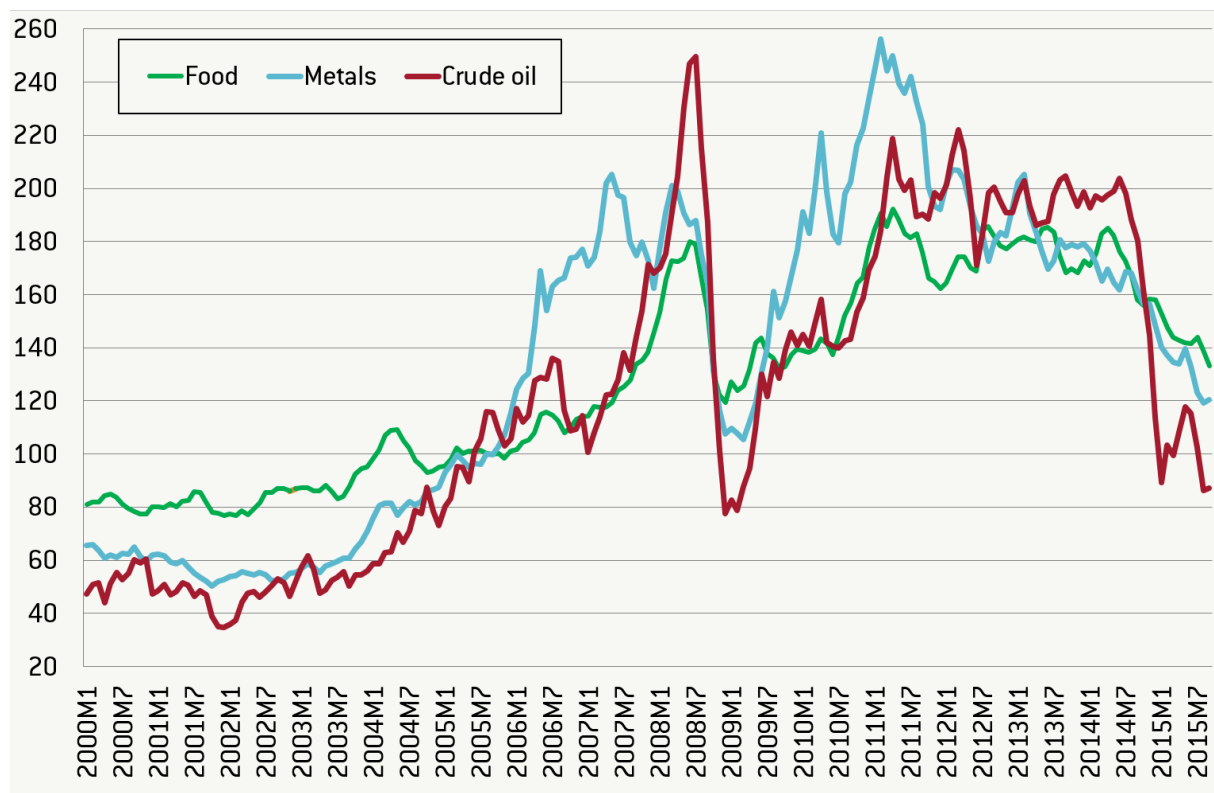
From 2005 to 2014, we saw a decrease in oil consumption in European OECD countries of approximately 2.4 million barrels per day (Lemons, 2014). One key factor in this can be the fact that Governments are pushing for green energy and climate changes are in focus as ever before. We have seen an increase in the use of green energy and climate changes has received much focus in the media. According to Fournier et al. (2013) Also, there were lower demand

than expected from Emerging market, which as described in the theory part are more oil intensive and dependent.

According to Baffes et al., (2015) the price decline we saw in 2014 could have been expected when looking at other commodity prices. Due to weak global demand and high supply, prices of other commodities have dropped. Looking at figure 15, we can see a clear pattern where crude prices for the most part follow price levels of food and metals. Oil prices, even though with a delay, in February 2015, the fall in oil prices fell and exceeded the fall in the other commodities. Fluctuations and changes in global demand could be one explanation of the price levels we saw after June 2014, but this should also be shown in other metals in the same period if aggregate demand was the dominant factor. We have seen similar patterns in Copper and Industrial metals, but nothing as dramatic as in crude oil levels. (EIA, 2017).

Given a decline in the global economy, this should also be reflected in price declines in other commodities, which has not been nearly as steep as the one we have seen in the oil price. This could imply that the supply side has played a more prominent role.

Figure 17 **COMMODITY PRICES COMPARED TO OIL**



(Dabrowski, 2015).

As mentioned in previous chapters, geopolitical aspects also play an important role in influencing the oil price. The conflict in the Middle East as well as the conflicts in Europe were expected to play a more significant role on oil supply than what it did. Expecting a situation with a decline in oil supply may have held the oil price artificially high before 2014, as in line with Killian's precautionary theory.

Between June 2014 and January 2015, we also saw an appreciation of the US dollar of more than 10 percent (Baffes et al., 2015). For countries not having their currency linked to the US dollar, this means a higher currency cost of oil. In line with the theory on demand presented earlier, this would lead to a weakening in the demand of oil, as well as a rise in the supply of oil from the non US dollar producers.

From December of 2014, we saw an increase in supply of 3.7 percent. The increase is quite high, although not remarkable when looking at the past five years. Nevertheless, the forecasted levels were however much lower than what actually were produced. Higher production levels in the United States, due to new fracking methods was not anticipated by analysts. Also, the comeback of the Libyan oil production was not forecasted. On top of that there was the OPEC decision not to reduce supply and the probable reemergence of Iran in the global oil market all probably added up to a shift in the expectations of oil supply in correlation to demand expectations (Kilian, 2015).

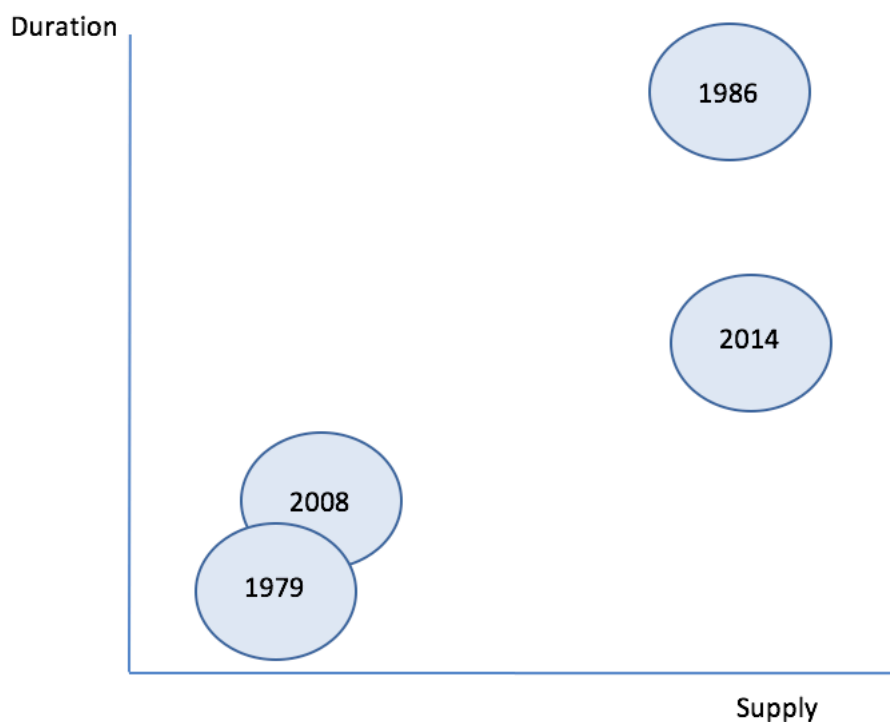
There seems to be a consensus among experts that much of the price plunge seen in 2014 come from the supply side and that Shale oil has undoubtedly been one of the main drivers for the oversupply we have seen in the market in the last couple of years.

#### 4.3.2. Why is this price plunge different?

The world has experienced oil price cycle before, and looking back at the past 30 years we have been through 5 significant price drops, where prices have declined 30 percent or more and lasted for more than 6 months. The magnitude and length of the cycles do differ however when looking at the peak-to-peak (Global Economic Prospect, 2015).

Looking at figure 18, we see oil price shocks from 1979, 1986, 2008 and 2014. The horizontal axis shows how much of the oil price decline was originated in supply issues. The longer to the right, the more supply driven the shock was. More to the left and the shock stemmed more from a demand side. The vertical axis shows how long the oil prices shock lasted, the further up, the longer they lasted.

Figure 18 OIL PRICE SHOCKS



(Authors own model)

Especially the declines we saw in 1986 and 2008 have some similarities to the decline we have seen since 2014, where both lasted long enough to be of a permanent character.

Figure 19 shows a comparison of the nominal price of crude oil and global production levels in 1986, 2008 and 2014. Looking at the figure, we see that the drop in prices we have seen in 2014 had a more gradual decline, and it was also less than what we saw in the other two periods. The global oil production also stayed relatively flat, with only a small reduction in the six months following the 2008 decline (Baumeister & Kilian, 2015).

After 1986, the oil price dropped and stayed low for fifteen years, and there are some parallels that can be drawn to the recent decline. In the 1970s, there was an increase in oil prices, the industry had experienced technological improvements and new fields started producing. This is very similar to what we have seen in the 2014 price decline. Prior to the decline, we saw record high oil prices and the industry was heavily invested. We also saw the rise of new oil fields in shale.

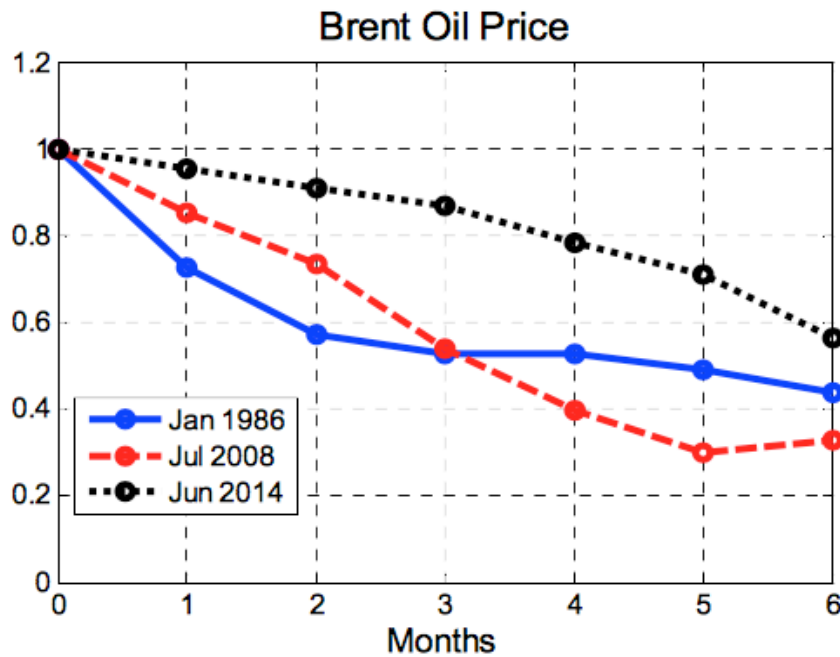
In the beginning of the 1980s, oil prices started to decline and OPEC cut production in an effort to raise prices. They managed to slow down the decline of oil price, but did not manage to stop it. Saudi Arabia took much of the burden, while the rest of OPEC took advantage of higher prices and production. Saudi Arabia lost market share and money. Reduced production on top of a lower oil price meant a significant decrease in Saudi Arabia's revenues. After a short period of time, Saudi Arabia changed their strategy from production cuts to gaining market share, much like what we saw OPEC do in 2014.

In the beginning of the 1980s, the US dollar appreciated before the US government worked for a devaluation in 1985 with agreement of other countries. The dollar lost 40 percent of its value between March 1985 and December 1987. After the price plunge, we saw in 2014, the dollar did not lose value, but instead increased by more than 12 percent in 2014 (Wall Street Journal, 2015). One of the main drivers that GDP growth has been lagging since second quarter of 2014 was the prominent decline in oil related investments according to Killian & Baumeister (2015). This is similar to what we saw after the price decline in 1986.

One difference this time compared to the price decline in 1986 was that the cycle on new production took much longer, and often decades before production started. Now, the production of shale in the US can start in weeks.

The 1979 oil shocks seems to be more originated on the demand side, as well as the decline in 2008 when the whole world went into recession.

Figure 19 HISTORICAL LEVELS OF OIL PRICE DECLINE IN 1986, 2008 AND 2014



(Baumeister & Kilian, 2015)

We also saw a fall in oil prices during the financial crisis in 2007-2009, but this was primarily due to slowdowns in the global economic activity. The general slowdown in the global economy also affected other commodities, which also saw a drastic decline in price levels (Davig, Melek, Nie, Smith & Tuzemen, 2015).

In the first part of 2008 saw prices reaching historically high \$144,29 before it had a sharp decrease and hit \$33,87 in November of the same year. The price decrease might have been similar to the one in 2014, but at the same time, the global market situation was not. The price decline we saw in November 2008 coincided with the backdrop of the global financial crisis; the world was holding its breath and global demand dropped. In September 15<sup>th</sup> of 2008, the Lehman Brothers filed for bankruptcy protection, the largest bankruptcy filing at the time (Oil & Gas, 2016). OPEC responded by cutting production by 16 percent during the next eight months, trying to bring prices up. Saudi Arabia stood for most of the cut, and also took much of the loss when Russia and Iran choose to continue with their productions and took market share (Oil & Gas, 2016).

The oil fall of 2014 have lasted longer than the one in 2008, but also went up faster after hitting rock bottom. In the last oil price decline, it took 126 days for the WTI price to reach \$51.55. In the price decline of 2016, we saw an increase from low levels of \$26,21 to \$51,23 for the WTI in 89 days. However, after reaching the \$50 benchmark WTI oil has not reached the same high levels as before, as it did in the 2008 price decline.

The 2014 plunge is difficult to pinpoint on the duration axis, as we do not yet know how the oil price will develop in the future, however it is placed close to the 1986 decline, as there are many comparisons that can be made.

#### 4.4. Shale oil and its possible impact on OPEC

To better understand how shale oil has impacted OPECs market power, I find it useful to go through Alhajji & Huettner (2000) description of the characteristics of a cartel, and at the same time discuss whether or not the shale revolution has impacted any of these. Being a cartel, OPEC should have a high degree of market power, if any of these characteristics have changed as a result of the shale oil, their market power should have changed as well.

##### 4.4.1. Quota system

According to Alhajji & Huettner (2000a), a cartel should have a quota system to have control of supply and prices. In the beginning, OPEC had a posted price system, but in 1982, they started their formal quota system. Studies show that the introduction of the quota system actually caused more friction within the organization, which in turn lead to increased transaction costs and resulted in a less frictionless organization (Smith, 2005), which is contrary to how a cartel should become more successful.

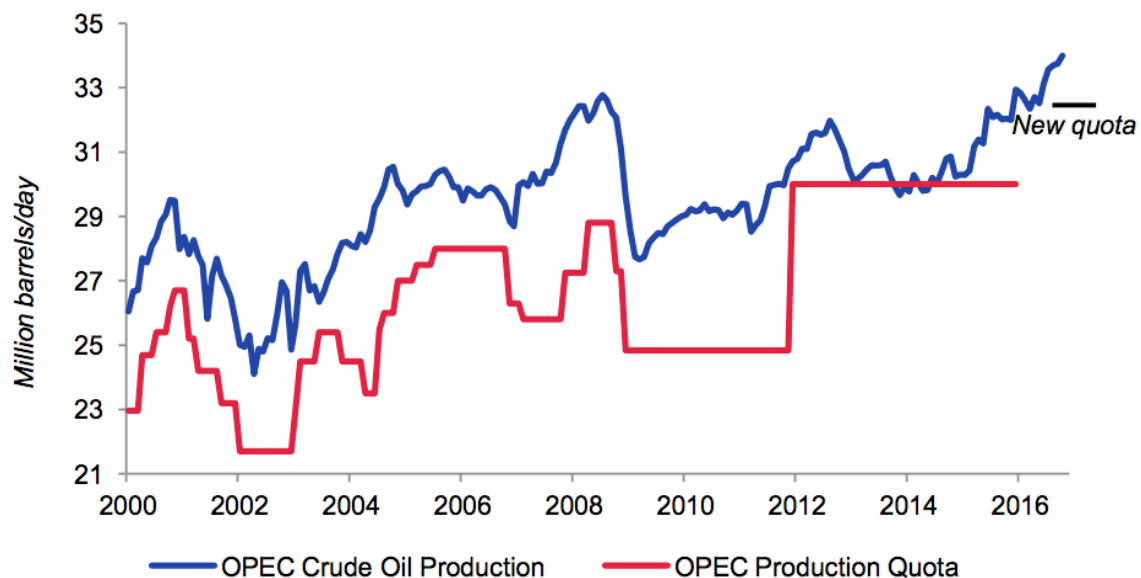
Having a closer look at the quotas OPEC set, Colgan (2014) found that OPEC members cheat on their production targets 96 percent of the time. Among OPEC members, deviations from quota seems more like the rule than to comply. Molchanov (2003) argues that OPECs production quota cannot be seen as an “output ceiling”, but more as the lowest level of production OPEC will produce.



Hamilton (2009) also did a study on the behavior of OPEC members and quotas and found, in line with Molchanov (2003) that their actual production numbers were different from OPEC announces quota. Some of the countries in OPEC overproduce or under produce for long periods of time. In many cases, OPEC has actually adjusted their official production quota after the production cheating has happened, so that these match. The overproduction happens first, and the quota changes to match these levels.

Figure 20 shows OPEC production quota compared to their actual production levels. It becomes quite evident that even though there have been production quotas, these have not been hold. Mostly, there has been overproduction. Even though a quota system is in place, it does not seem to be very effective.

Figure 20 **OPEC QUOTA VS ACTUAL PRODUCTION**



(Oyedele, 2017).

OPEC reduced their quota effective from January 1<sup>st</sup> 2017, as a response to the oversupply in the market. Following the recent price decline, and OPECs decision to cut in production

levels as of January 1st 2017, their cut is one of the largest cuts we have seen in OPECs history.

As mentioned in previous chapters, the shale production was not anticipated and we experienced an oversupply in the market compared to demand which have resulted in a decline in oil prices. When OPEC in the end of 2014 decided to not cut in their production, it can imply that they chose a squeeze strategy to try to get rid of competition. While OPECs members benefit from higher prices, they also benefit from squeezing out the competition. Traditionally we would have seen production cuts from OPEC following an oversupply and lower price levels. Their decision not to take on the swing producer role and instead opt for market share implies that this was a strategic choice towards shale.

#### 4.4.2. Monitoring system

A second characteristic according to Alhajji & Huettner (2000) is to have a monitoring system in place. To be able to reprimand members who cheat, the cartel needs to be able to detect cheating. OPEC have the Ministerial Monitoring Committee where they send people to selected countries to check if they follow the quota. This is however only for a short period, and was first established 25 years after the establishment of OPEC. The compliance to produce according to the quota seems to be based on trust rather than having a working monitoring system in place. Looking at production data, the production levels are often different when looking at data produced in OPECs bulletin vs other sources, like IEA. Even though there seems to be a lack of a good monitoring system, it does not seem as though the rise of shale has played an impact on this.

#### 4.4.3. Punishment of cheaters

The third characteristic is a way of punishing cheaters (Alhajji & Huettner, 2000). To prevent its members from cheating, a cartel needs to have some sort of punishment system. This is very common in most cartels. Although some argue that Saudi Arabia increased their production in 1986 as a form of punishment, OPEC as an organization does

not have a punishment system to discourage cheating. There does not seem to be any clear impacts of the rise of shale in concern to this. However, one could argue that stakes for OPEC are higher than ever before. If OPEC members do not comply, they could be punished by facing lower oil prices for a longer period of time than if they were to stand jointly.

#### 4.4.4. Cartel Authority

Cartel authority is listed as the fourth characteristic by (Alhajji & Huettner, 2000a). The cartel authority should be more prominent than its members for the cartel to be functional. In OPEC, the governments in the different member countries have the final call, and is above OPEC in authority. This seems evident, especially when looking at the quota cheating through OPEC's history. Neither this seems to have been impacted by shale. There is no suggestion that the cartel's authority in relation to member governments has changed after the rise of shale.

#### 4.4.5. Buffer Stocks

A classical cartel organization often has a buffer stock where producers get a side payment to keep production levels low and thus achieve higher prices at the market. Buffer stocks is the fifth characteristic of a cartel according to (Alhajji & Huettner, 2000a). Cartels often have a collection of the commodity in stock, to keep prices within a given range, and this is often a part of their cartel agreement. If prices were to decline under the range, the cartel will use from the buffer stock to buy the commodity in the free market and thus increase the prices. If it should increase, the cartel would sell the commodity to achieve lower prices and also to prevent substitution.

Looking at OPEC's history, they have never had buffer stocks. Other cartels often have a minimum and maximum price range, but OPEC does not have either a minimum nor maximum price level but has rather had a guided price and production quota.

On the other hand, one could argue that having spare capacity can be seen as OPEC's buffer stocks, and that this has played a part in influencing the prices. For OPEC to be able to play

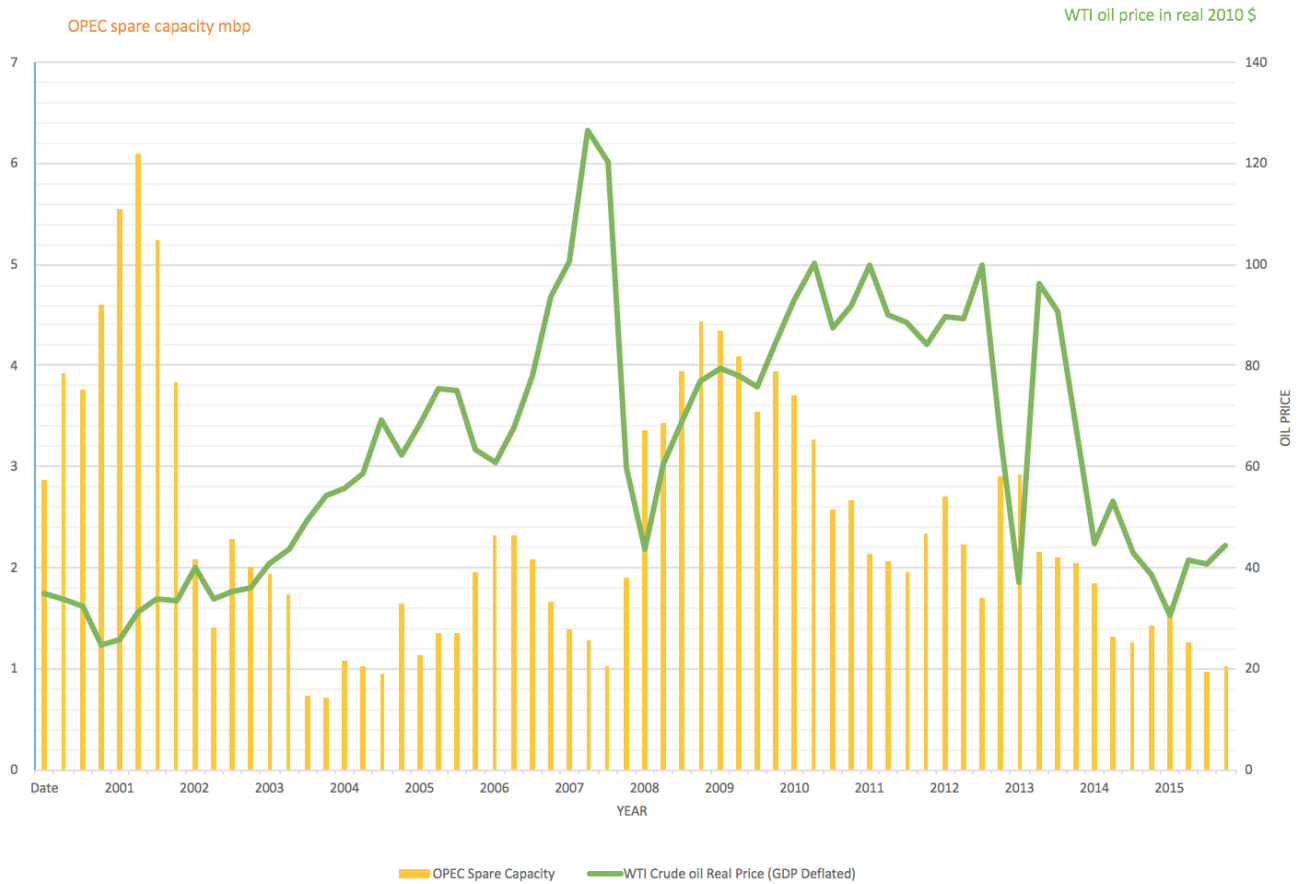
the role as a swing producer, they need to be able to respond to the market, and have enough spare capacity to do so. If the market is not in equilibrium, they need as a swing producer, to have the capacity to tap into their spare capacity levels and flood the market until it reaches balance to avoid low oil prices. 2008 was a great example of this, although it can be discussed and questioned how much of a part OPEC played as a group, as almost all of the cuts were made by Saudi Arabia, and many if the other members continued to produce at the same levels as before.

Happonen (2009) found that OPEC seem to have announced spare capacity of higher levels than what was actually the case. Saudi Arabia for instance seems to have announces spare capacities above the actual levels. As spare capacity is an important factor to for OPEC to have market power, it might imply that they want to give the impression of having more spare capacity than they do in order to keep their position. There is also some challenges and confusions as to how the spare capacity is measures. OPEC member countries provides its estimates of its reserves but there is no policing of how this should be calculated.

During the 1980s and the 1990s, OPEC had high levels of spare capacity, which helped them in the act of being a swing producer as well as meeting global demand.

Looking at figure 21 we get an overview of OPECs spare capacity levels. After they increased their production levels to gain market share in 2014, their spare capacity levels reduces as a result. The lower levels of spare capacity impacts their ability to respond quickly to the market. If this continues, they might find themselves in a situation where they cannot respond to changes in the market.

Figure 21 OPEC SPARE CAPACITY AND WTI CRUDE OIL PRICE



Authors own model based on data from IEA (2017).

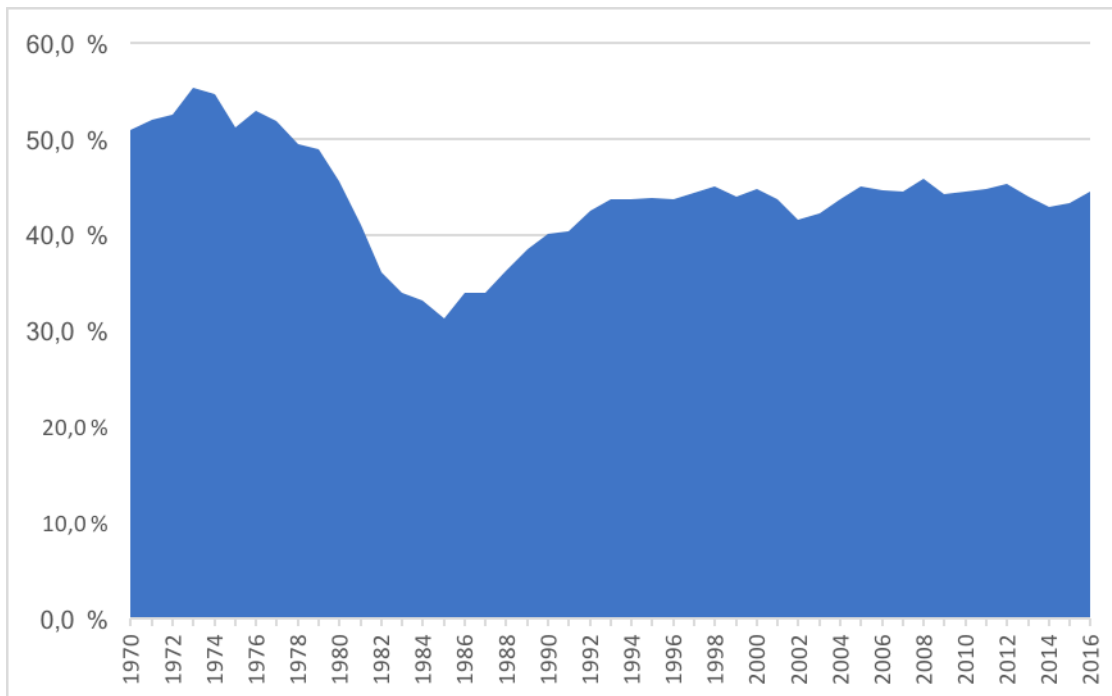
OPECs effective spare capacity is at its lowest of eight years. 90 percent of their spare capacity is in Saudi Arabia (Arab Gulf States Institute, 2016), which is line with the dominant firm view holding Saudi Arabia as the dominant firm within OPEC.

#### 4.4.6. Market share

Having a large market share is the sixth characteristic of a cartel (Alhajji & Huettner, 2000a). Using data from OPEC monthly statistical bulletin and using a simple model comparing the total world production to OPEC production we see OPECs market share in figure 22.

From the figure, we see that OPEC used to have market shares of more than 50 percent in the 1970s.

Figure 22 OPEC MARKET SHARE PERCENTAGE OF WORLD PRODUCTION



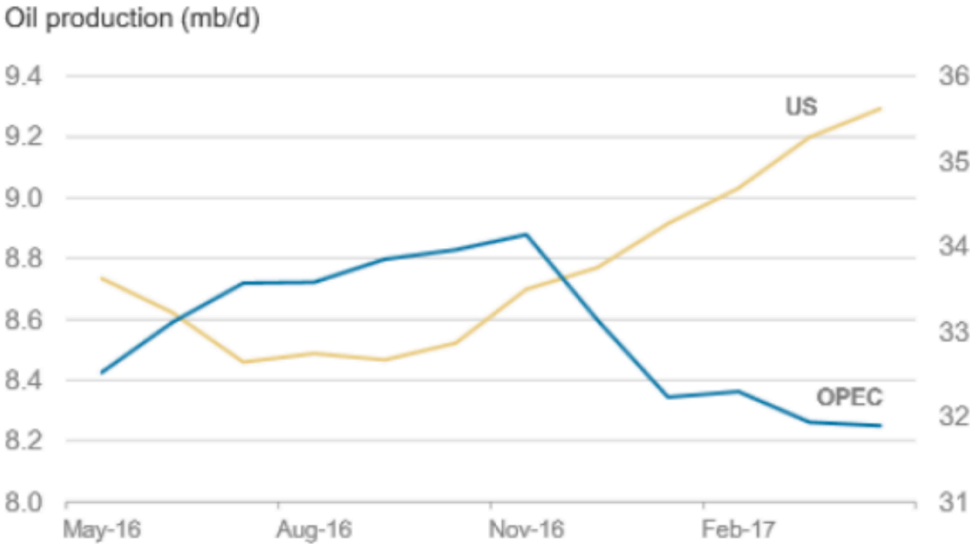
Author's model based on data from IEA (2017)

From 1970 to 1977, OPECs market share was above the 50 percent mark, but then saw a decrease in their market share from 1978 all the way until 1988 when their market share was 36,2 percent. The following years we saw a gradual increase in their market share, reaching 45,1 percent in 1998. In 2009, following the price plunge in 2008, their market share was 44,2 percent.

OPECs market share have fallen from their high 50s percentage, but we have seen a small increase in their market share following their decision to gain market share in 2014, and in 2016, they had 44,5 percent.

Looking at figure 23, we see production levels right before and after they cut their production levels in the beginning of 2017. Shale oil has surpassed OPEC in production levels, and are producing higher levels, gaining market share from them.

Figure 23 OPEC VS US PRODUCTION



(Durden, 2017).

In addition to the characteristics listed above, Bhattacharyya (2011) further listed up some key factors that make makes for a stable cartel. Group size, group characteristics and a spread and large number of buyers.

The cartel should have few members. Having only a few members’ means that it is easier to control the cartel. OPEC, having thirteen members, OPEC is not a small organization and the non-compliance to production quota implies that there are difficulties in controlling each member.

According to Bhattacharyya (2011) group characteristics is another important determinant. Having a homogenous group with inelastic demand is more prone for success than having a heterogeneous group. Having a closer look at OEPC, the group is far from homogenous. Saudi Arabia have reservoir big enough to continue production for six decades without having to make new discoveries or improve significantly in technology (Hupman & Holz, 2015). Angola and Algeria on the other hand, only have the possibility to continue in the same matter

for around 20 years (Hupman et al., 2015). This implies that Saudi Arabia can have a more long-term outlook than the latter two. The different member countries also produce different oil blends, where some produce sweet oil and other sour. Even though they are all producing oil, the blend is different.

Alhajji & Huettner (2002c) also argue that the countries like Algeria and Angola are more likely to focus on meeting a set income level, rather than focusing on profit maximization, which is in line with the target revenue model. There has also been reported in media, some rivalry within the organization as well as more unproductive meetings (Behar & Ritz, 2016). In their mid 2014 meeting, Saudi Arabia's oil minister arrived late, and argued for only having one meeting per year as he meant their meeting were becoming unproductive. (Wall Street Journal, 2014). There seems to be difficulties within the organization, and this clearly impacts the strength of OPEC. Having a united organization is important for success. Especially setting their strategy as a result of shale seems to have made some rifts among members, as they have had difficulties reaching an agreement.

The last characteristic, which is having a large numbers of buyers, is important as it obstructs buyers to conspire and work together. Looking at table 2, OPEC have a large customer base, which are also diversified. We see some changes in their export data from 2011 to 2015, and especially looking at North America and Middle East. It is difficult to say with certainty, but shale does seem to have played an important role in this shift.

**Table 2. OPEC Members' petroleum product exports by destination (1,000 b/d)**

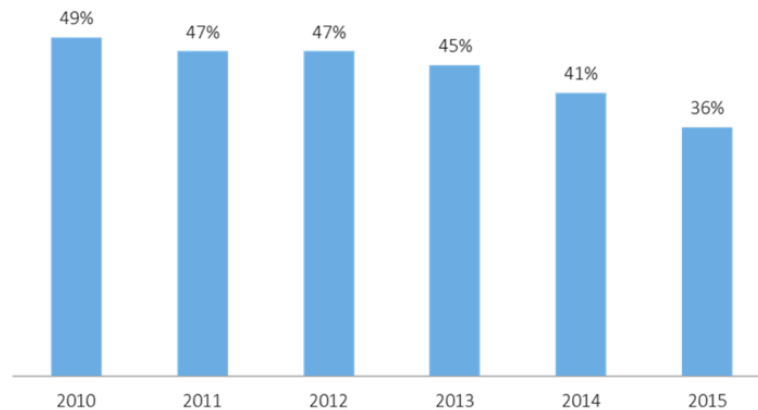
<b>Region</b>	<b>2011</b>	<b>2015</b>
Europe	708,7	755,9
North America	610,9	207,2
Asia and Pacific	2483,9	2993,8
Latin America	450,2	330,8
Africa	187	272,7
Middle East	244,2	431,2
Total	4684,9	4991,6



(Authors table made on data from OPECs statistical Bulletin 2016).

From figure 24, we see an overview of OPECs share of imported U.S. oil import. In 2010, OPEC crude oil accounted for 49 percent of total imports in the U.S. In 2015, the number is 36 percent. Shale oil has made the U.S more independent and less import is needed. This might imply a direct change in the customer base of OPEC as a result of the shale oil.

Figure 24 **OPECS SHARE OF U.S. OIL IMPORTS**



EIA (2016)

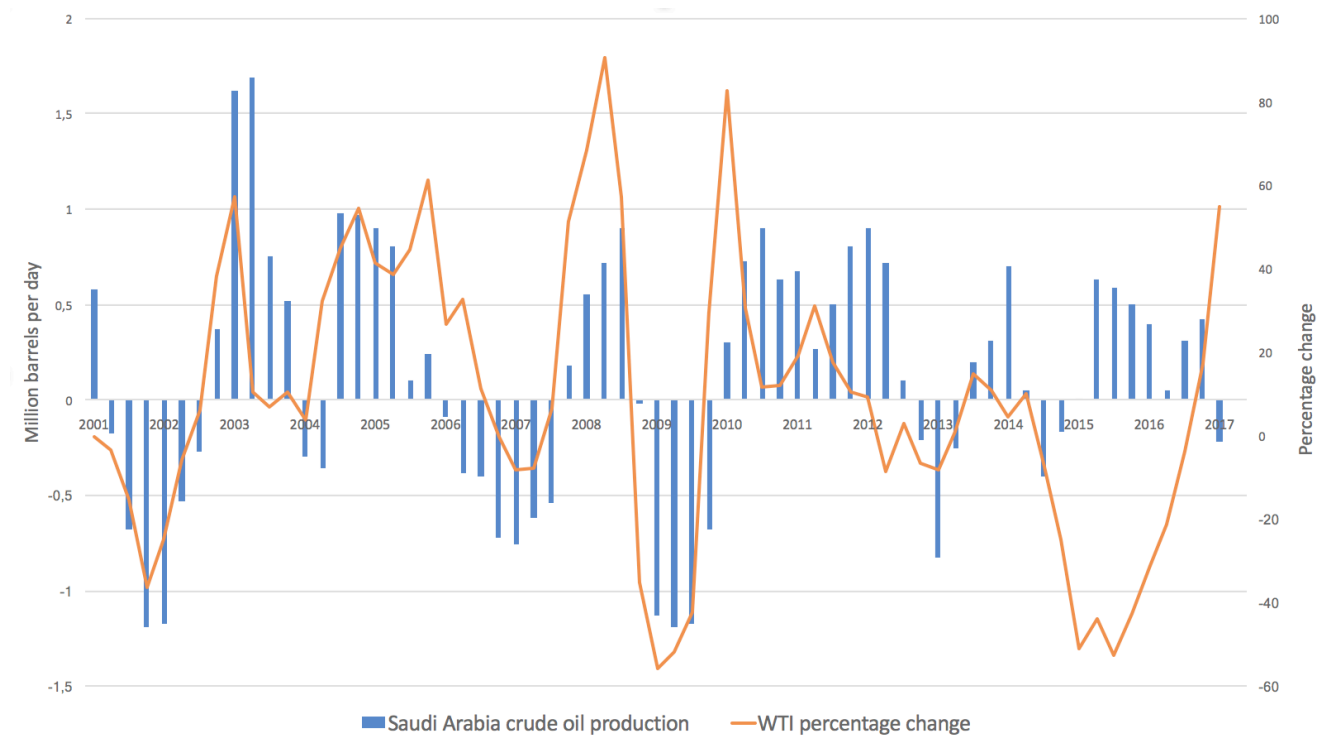
#### 4.5. Short term and long term effects

As demand for oil has gone down, and prices have declined, you would expect supply to decrease. This was not the case after the 2014 plunge. At the same time, you would expect to see an increase in supply as demand and prices rise as it did prior to 2014. Given the long lead-time of oil production, it can take years to rise the production levels. Oil production do usually not respond to price fluctuations in the short run. From finding, a new field to actually be able to produce can take years. Having this long lead-time, it means that suppliers to the oil market can only meet demand within the boundaries of their spare capacity in the short run. Shale oil has however changed the nature of the game, as they have much shorter production time than conventional production. In addition, while consumption is very inelastic in the short run, having very high or very volatile oil prices may lead to substitutions and low demand for oil in the future.

Another reason as to why we have not seen production decline might be because many of the oil producing countries are depending on their oil revenues to manage the country expenditure. While lower production should lead to lower prices, which in turn would benefit all OPEC members, the individual members would benefit most if the other members were to cut production while they cheated the system and benefited from higher prices. Looking at Saudi Arabia, they had a breakeven of \$96.10 per barrel in 2015 due to their welfare programs and energy subsidies. To reach their breakeven prices, these countries either need prices to peak, or to sell as much as possible to reach their budget. This seems in line with the target revenue model.

For a situation where supply is higher than demand, we would expect to see a decline in prices. As oil is relatively inelastic in the short run, we should not see many changes in demand in regards to changes in oil prices and we would not see many changes in quantity demanded, but in the long run, demand should increase as a result of lower oil prices. Supply and demand has traditionally reacted slowly in the short run, but in the long run, they might react differently.

Figure 25 CHANGES IN OIL PRICE AND SAUDI ARABIA OIL PRODUCTION



Authors own model based on data from IEA (2017)

Figure 25 shows a comparison between the WTI price and Saudi Arabia's oil production. It shows a clear correlation between the oil price and changes in Saudi Arabian production levels in the short run, and paints a picture showing that at least in the short run, OPEC still have some power at influencing the oil price.

#### 4.6. Discussion and final thoughts

In the theory part of the paper, we saw that under perfect competition, the firm must accept the price determined in the market. The firm is a price taker and can produce as much or as little as it likes without affecting the market price. This does not seem to fit with the market situation we have in the oil market. OPEC has clearly influenced the price levels and the perfect market competition does not comply here. In a competitive market, prices should equal marginal costs. Faced with a monopolistic market, the monopolist can choose a price above their marginal costs, and also hold back on production so that supply does not surpass demand and lower prices. Looking at production data, we can see that OPEC or Saudi Arabia have acted as a swing producer in the sense that they have held back on supply whenever supply surpassed demand, but since oil prices are influenced by so many different factors it is difficult to determine the actual impact. It seems clear that OPEC is not a monopolist as this is an extreme version, but the organization seem to have some of the characteristics of a cartel. They are a self-proclaimed market stabilizer and have a joint strategic goal of keeping oil prices high. OPEC has clearly utilized market power throughout history. On the other hand, OPEC did not introduce a quota system before 1985, this was not a strict path, and did not involve a monitoring system. In addition, Saudi Arabia and Iraq was not a part of it. Saudi Arabia seems to decide on their production levels based on their own interests, not OPECs, which is line with the dominant firm view.

Oil supply and demand curves are steep, meaning that they are very price inelastic in the short run. As a cartel, OPEC should be operating on the elastic part of the demand curve, while studies done show that they are actually on the inelastic part.

In May 2017, as this paper is written, there was a decline in oil prices of 13 percent. This coincides with high levels of US shale oil production, as well as a doubling of oilrigs the last year. Numbers show that U.S shale can be profitable as long as prices stay above \$40. As long as prices are above this, shale will probably, still be in business, even if OPEC cuts. In the

past, their breakeven levels were much higher. This implies that OPEC does not have the same market power as they used to and that OPECs effort to raise oil prices have not been as successful as wanted.

Shale oil represent a shift in the supply of oil. Before shale oil, non-OPEC production was considered to be gradually declining. The shale oil revolution can possibly change the supply dynamics of the global oil market in the long run. Shale oil has greater price elasticity than conventional oil (Halff, 2015). While the traditional oil companies are traditionally large, have long lead-time and have been claimed to be highly bureaucratically. Companies producing shale oil on the other hand are often small and innovative with much lower lead-time. They require less investment in the initial phase than conventional and produce revenue faster. All this implies that OPECs capacity to manage the market through production cuts have been lowered. As prices would fall, shale production rise.

Going through the characteristics, we saw that the rise of shale has clearly affected areas of OPECS organization.

Having spare capacity levels is important to be able to respond quickly to changes in the market. These levels are lower than what they have been in the past, due to OPECs response to higher production levels of shale. This has an impact on OPECs ability to act as a swing producer and respond to market changes. One example where OPEC used its spare capacity successfully was during the Asian Economic crisis, were we saw prices fall in 1998. OPEC adjusted their production and seems to have controlled the market. The price of oil was between \$15 and \$20 much due to OPECs production targets, and we could have seen much lower prices had it not been for this.

That leads us to a question. Why did not OPEC cut production levels in 2014 to try to rise prices? OPEC can handle a much lower oil price than other unconventional oil production. Having low oil prices will benefit OPEC in the sense that growth in shale production will probably slow down as they find it difficult to receive investments and operate above their break-even levels. As discussed in previous chapters, this might imply that they deliberately left the swing role in order to squeeze competition. This does not seem to have worked as well as they might have hoped for. For OPEC, in the short run it would make sense to drive prices up, which in turn would rise their revenue. At the same time, this also makes entry from competitors more likely as well as oversupply in the market and thus lower prices.

OPEC has sent a plea to the US to reduce in their production levels, as there is still too much supply in the market. In their plea, they state that in order to balance out the market it "requires the collective efforts of all oil producers" and should be done "not only for the benefit of the individual countries, but also for the general prosperity of the world economy." (Kottasova, 2017). It seems shale oil has restricted OPECs market power to keep prices at a target level.

Huppmann and Holz (2012) find that OPECs market power has declined significantly since the crisis in 2008 and Fattouh and Mahadeva (2013) find that this decline is because of changes in market conditions.

It still remains to see what will happen, but it might seem as though the squeeze strategy OPEC has chosen may be less successful than anticipated. We have not seen a significant decrease in US shale production due to their decision to keep production levels despite a glut in the market, although there has been a rise in price level.

Since OPEC decided to cut production by 2,2 percent in November 2016, the price doubled as of February 2016 (Kottasova, 2017). In their last meeting on May 25<sup>th</sup> of 2017, they decided to keep this cut for another nine months. 1 day after announcing their intention to cut in production, we saw prices beginning to rise. This might imply that in the short run, OPEC still have the power to affect the price, but in the long run there are many other mechanism playing a role and that changes in GDP growth, geopolitical issues and demand is difficult for OPEC to change in long run. Shale oil may have changed the market both in the short and long run, but OPEC seems to still be an important player. If shale production were to stop, and prices rise, OPEC may again see their market share and market power rise.

For future research, it would be interesting to have a closer look at how much impact anticipated changes in OPEC quota have on the oil price. It seems, as the price level of oil has stayed artificially high as the market awaits OPECs announcements. Their meeting in late 2016 seems to be one example of this. In addition, it would be interesting to study whether or not OPEC should apply a squeeze or accommodate strategy given the recent changes in the oil price. How long can OPEC survive on low oil prices before they reach too high levels of budget deficit? It will be interesting to see how the production cuts OPEC started in January

1<sup>st</sup> of 2017 will affect their market share in the future, and if it will help raise oil prices to levels, we have seen before.

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