# Diplomarbeit

**Auslageexemplar**

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Thema:

**Managing price risk for physical oil products with derivatives on the Bulgarian local market**

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# 1. Introduction

## 1.1 Problem definition

In the history of oil trading there has been a great number of unpredicted changes in price movements, political influence and dependency, and variations in supply and demand ratio. All of that has led traders and investors to adapt their ways of doing business to these challenges, with the main aim, to cover their price risk exposure. Price volatility and geopolitical issues were some of the crucial factors that have led to the introduction of new financial tools to the energy sector.

For many years, businesses in the energy sector have used derivatives to reduce their exposure to volatile prices, to limit their need for cash cushions, and to finance investments. Furthermore, these financial tools allowed the locking of a profit margin or a desired price, the covering of a certain price risk exposure in the future, and the "smoothening" of the cash flow curve. Derivatives made it possible for anyone to access the energy commodity markets and to buy or sell products without having any intention of taking delivery. Financial institutions, banks, funds, and individuals entered commodity exchanges with the sole intention of making money.

With time the energy market, and in particular the oil market, was the playground for hedgers and speculators who had two different aims: covering price risk exposure and making money through taking diverse positions in the future. All of that has led to the separation of the oil market into two – a physical and a financial market. There was the physical product, which was supposed to be delivered at a specified point in the future. The one that makes one's hands dirty. But when oil and oil products entered the futures market, everything changed. Many saw in it a chance of making fast profits through speculation, making this new (financial) product one of the most traded in the world.

Petroleum has, and will continue to have, an immense influence on the lives of people around the world. Firstly, crude is a commodity that is produced in certain geographic areas, but it is used or processed all over the globe. Secondly, it is a non-renewable energy source, meaning that its significance will rise with time. Nevertheless, oil continues to be the primary energy source with 32.8%, followed by coal with 27.2%, and natural gas with 20.9%.[1] Although the European Union (EU) is aiming at the reduction of carbon emissions and the increase of renewable energy sources in the near future, petroleum is still believed to retain its leading position in the next years.

To cope with the problematic of the oil markets one should acquire sufficient knowledge of the following key problems:

- the factors that influence the oil price
- and the financial instruments used to manage price volatility

The combination of economic and technical knowledge, which is needed for the understanding of what is moving the oil prices, has forced the market participants to develop various hedging strategies. A desired product price could only be achieved by using derivatives.

[1] International Energy Agency, "Key World Energy Statistics," (2011): 6.

But there still remain risk factors that are impossible to predict or identify. Natural disasters, wars and political decisions are just some of them. The truth is that oil prices have become out of control in present times. This is why it has become of crucial importance for oil businesses and traders to hedge their supply and demand chains, in order not to fall victims of the price volatility of oil and of the risk exposure in general.

The oil market covers the whole world, but the risk identification, risk measurement, and risk mitigation tactics can be applied to any local market due to the following reasons. There are benchmarks like Brent and WTI that are international standards for all crudes in the world. Also the existing commodity exchanges like the Intercontinental Exchange (ICE) in London and the New York Mercantile Exchange (NYMEX) make it easy for market participants to hedge their production or supply using the crude or gasoil (heating oil) futures. But as crude and oil distillates are traded in US Dollars (USD), the currency risk from exchanging USD into local currency can have a severe impact on the final price.

## 1.2 Objectives

This diploma thesis will focus on the management tactics used to cope with the price risk of physical oil products with the use of derivatives. As price risk can be defined as an unfavourable movement of a price of a product in a future point, many factors must be taken into consideration. But as the oil market is covered by an incomprehensive fog, that maybe only a few people in the world posses the power to unveil, the precise quantification of all factors could never be accomplished to a degree of one hundred percent. This is why the focus of this thesis will be on the following points:

- risk identification, measurement and mitigation
- derivatives and their use in praxis
- price and currency risk
- major price formation factors for crude and oil distillates
- local and global benchmarks
- specifics of the Bulgarian local market

In short this diploma thesis aims to present and analyse the derivative instruments in order to provide an overview of the oil markets and the way market participants can deal with the innate risk exposure.

Although there are many information sources like Platt's, Bloomberg, Reuters, OPEC, IEA, ICE, NYMEX and many business services like PricewaterhouseCoopers (PWC), Citigroup, KPMG, it is important to note that the existing data is not always 100% complete and that recommendations and forecast should be followed at one's own responsibility.

## 1.3 Structure

This diploma thesis consists of six additional chapters. The next one will build on the introduction, providing more data and facts about the oil price movements and their influence in present times.

Chapter three will deal with the theoretical foundations and it will provide the basics, needed to understand oil and oil products. In addition it will offer a description of the oil market and the financial world.

Chapter four is called “Managing the Risk”. It will give detailed information on risk management and the types of risk exposure. The main topic will be the types of derivative instruments and their use for mitigating risk. Furthermore there will be a part dedicated to risk measurement methods.

The next chapter is named “Lukoil and the Bulgarian local market”. It will present facts on Lukoil, as it is the only refinery in Bulgaria and the biggest player on the local market. Furthermore it will provide local market analysis, an overview on logistic possibilities, and an insight on local laws and regulation. The main part of this chapter will deal with the development of the “Lukoil” prices as compared to the Platt’s FOB Med quotation and the USD/BGN exchange rate. In the end, local risks will be considered and a forwards example will be given.

Chapter six will present the author’s hedging recommendations. It will provide a table of hedging actions for different products with different derivative instruments. Finally it will offer an example of a fuel oil swap for the Bulgarian market.

The final chapter is the “Conclusion” and it will summarize the presented problems. It will be followed by a glossary section with common terms and abbreviations.

# 2. Current Situation

> *"[It's] sort of a reverse social Darwinism: The more complex societies get and the more complex the networks of interdependence within and beyond community and national borders get, the more people are forced in their own interests to find non-zero-sum solutions. That is, win-win solutions instead of win-lose solutions.... Because we find as our interdependence increases that, on the whole, we do better when other people do better as well - so we have to find ways that we can all win, we have to accommodate each other. And, on balance, that's a humanizing and elevating development."*[2] Bill Clinton (2000)

Maybe these words of former U.S. president Bill Clinton can to some point explain what has been a driving force among investors in the last decade. The necessity to cope with various new challenges and the need to remain competitive has compelled them to adapt their ways of doing business. As a result non-zero-sum answers were developed, in order of win-win scenarios to happen. This is where derivatives come in question, as they allowed all kinds of possible future scenarios to be considered by ways of taking long or short positions. Hedging and speculating became a considerable part of the financial world, as managers were able to adjust the portfolio of a company according to market movements and predictions.

With time, derivatives opened the doors to markets, which were mainly the playground for the professionals in the corresponding field. Among markets like commodities, stocks, and indexes, the energy market - and in particular the crude oil futures - offered many lucrative opportunities for investors. The sole reason for that was the high price volatility of crude and other oil products.

As crude oil serves as the raw material for physical oil products (diesel, gasoline, gasoil, fuel oil, jet fuel), its price movements don't only influence the oil market as a whole, but also play an important role in financial and geopolitical decisions. That means that understanding what is driving the oil prices is of crucial significance to both professionals and newcomers to the market.

The price fluctuation of Brent (the major global benchmark for crude oil) in the past years has arisen countless questions regarding the main reasons behind this phenomenon. As companies and market analysts are often taken by surprise by the volatility of this precious commodity, many reasons are given to explain what is actually happening. The main clichés for what is moving the oil price are the following:[3]

- Limited supply from the producing countries (OPEC), which cannot satisfy the growing demand for oil.
- The increase in demand from China and India, which is disturbing the stability of the oil market.
- Tensions in the Middle East.
- The possibility of a decrease in the ratio of crude reserves/ crude production and as a result the available spare storage capacity.

[2] Wired Magazine Bill Clinton, "Wired 8.12: Bill Clinton," http://www.wired.com/wired/archive/8.12/clinton.html?pg=3&topic=&topic_set=, accessed January 2012.
[3] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 2–3.

- The excessive taxes on petroleum products (gasoline, diesel, jet etc.) imposed by European governments due to the low-emission environmental politics of the European Union (EU).

But a look at the Brent quotations in Figure 1 shows that the above clichés cannot give the precise answer to what is really happening in the oil market. If we take the Gulf War in the beginning of the 90s for example, it is clear that war and political unrest do have an impact on oil prices. The crude prices doubled but later fell down to their previous level.

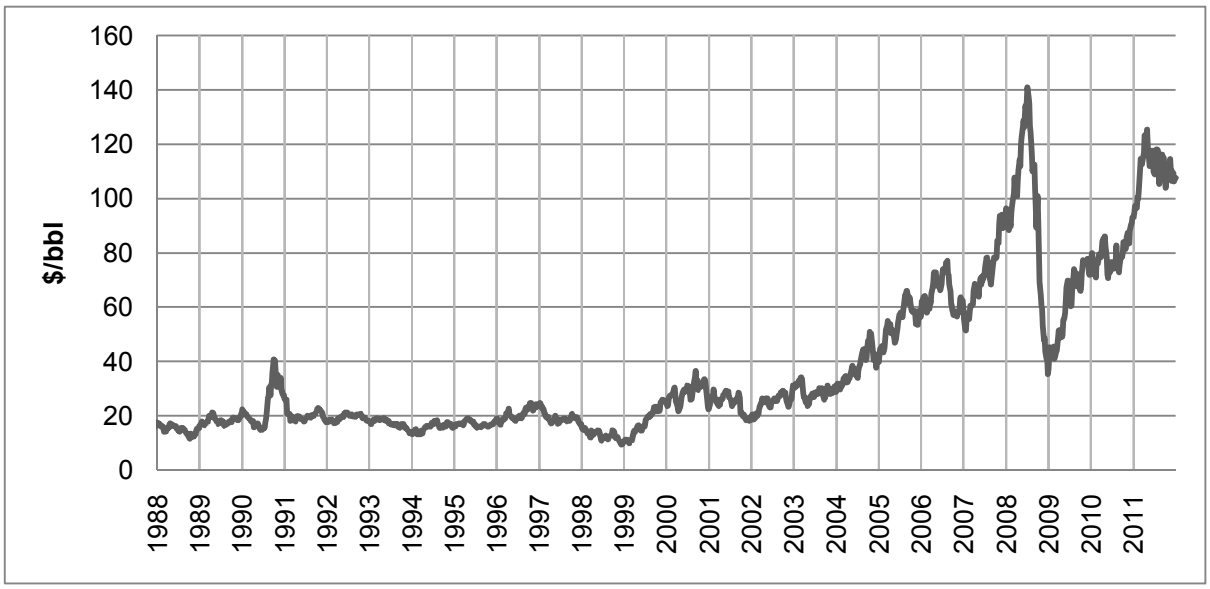



**Figure 1 Weekly Europe Brent Spot Prices FOB 1988-2011**[4]

Most of all is the climb of oil prices to over $140 per barrel in the summer of 2008 and their surprising fall to less than $40 by the end of the same year, just to reach $120 per barrel in 2011, is what has caused a massive disturbance in the field. Apart from inflation (although its role in price increase can be predicted and calculated) none of the usual statements can provide a sufficient answer to what has really happened in that period of time. As a non-renewable energy source with limited quantity reserves around the world, it is logical that petroleum would gain in value with time. But such fluctuation cannot be explained with beliefs of this kind.

The truth is that the responsibility for this phenomenon should be taken by the financial sector. The financial crisis of 2008-2010 is what upset the plans of many around the world. As financial institutions and traders began to struggle to receive lines of credit and letters of accreditation, the liquidity of the oil market was deeply damaged. The purchasing power of many of the market participants was sharply reduced, which led to a decline in the demand for petroleum. But mostly it was due to the speculating of financial institutions that allowed for this price “shock” to happen. The remarkable rise of Brent to over $140 per barrel was preceded by a series of analyses by the American bank Merrill Lynch and other banks. They predicted that the prices would go up to $250 per barrel, which influenced the market participants to buy with the hope of making easy money.[5]

[4] U.S. EIA, “Weekly Europe Brent Spot Price FOB,” http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RBRTE&f=W.
[5] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 102–103.

But when the crisis struck them, they were forced to sell those futures contracts, in order to cover loses or to pay bills. Because of the reduction in demand, the price rapidly sunk. Eventually, there was greater supply, then demand. As simple as it sounds, the price of oil can be expressed by the laws of supply and demand. If there is greater supply then demand - prices will fall and vice versa.

However the supply and demand discussed above are not just the production and consumption ratios of petroleum, but a complex network of physical, economical, financial, and geopolitical factors that influence the oil market every day.

$$\text{Price of oil} = \text{f}(\text{supply}, \text{demand})$$

As the oil market is indirectly linked with the world economy, it is hard to pinpoint all the factors that have an impact on the price of the product. Although some of them are already known to the general public (clichés), there are risks that are almost impossible to predict and define.

If we take for example the unfortunate events in Fukushima, Japan in March 2011. The country was struck by a natural disaster, which devastated the land and severely injured its energy sector. There were countless debates if it was right to continue using nuclear power as an energy source. At that point, it was not clear whether Japan will decrease its use of oil and oil products in order to reduce its resource dependency. Furthermore, as part of the country was in ruins, it was uncertain if the immediate demand for oil would increase or decrease. In the end, there were many scenarios, which dealt with the price movements of petroleum.

This is where hedgers and speculators join the game, as high price volatility was expected. Hedgers wanted to reduce or cover their price risk exposure if prices went up. Speculators wanted to make money. For the last ones there were two possibilities - to bet on increasing or decreasing oil prices. But as both of these possibilities were likely, the risk was greater. But so was the expected profit.

What this example aims to point is that as long as there are price fluctuations, there will be people who will take precautions or take risks. Although the world economy has started to recover from the crisis in 2008, the damage it has suffered will not be forgotten fast. Though some people tend to have a selective amnesia, concerning the harm derivatives can have, many have learned their lesson.

As a whole, the oil market is once again going on a price merry-go-round, where volatility is an innate factor. With unknowns like Iran in early 2012, it is very uncertain what will happen in the near future. One thing is for sure. The answer to the question: “To hedge or not to hedge?” remains entirely to the company management. As both options have pros and contras, it is important to measure the risk exposure and to create eventual hedging strategies.

# 3. Theoretical Foundations

## 3.1 Petroleum

### 3.1.1 Introduction

Petroleum is a liquid fossil fuel formed when decaying plant life becomes trapped in a layer of porous rock. After millions of years, heat and pressure convert this decaying plant life into hydrocarbons. Some of these hydrocarbons are gases, others are solids (coal), and still others are liquids. Petroleum derives its name from Latin and literally means "rock oil". It is the genetic name for any hydrocarbon that is in liquid state under normal pressure and temperature conditions. As other fossil fuels, the mixture of hydrocarbons in petroleum can vary widely. When it is firstly extracted (from the solid ground or by deepwater rigs), it is called crude oil. Its name can also be associated with many other hydrocarbon fuels like gasoline, heating oil, jet, and diesel.[6]

Burning crude oil directly can be dangerous since the lighter portions can form explosive vapours and the heavier portions may not flow easily or ignite smoothly. This is why crude oil is separated into components that are more homogeneous in composition. It is also important to note that petroleum in liquid state has far greater energy per volume properties then gases like propane and methane. As a result crude oil products are more suitable for burning in engines.

But before the introduction of the gasoline engine to the market, people used petroleum products for rather basic needs – lightning, heating, cooking, and lubricating. When the first oil well was drilled in the States by Colonel Edwin Drake in 1859, no one could have ever imagined the impact this product would have over history. Investors of that time saw the opportunity to compete with whale oil in the illumination market by providing a similar product – kerosene. Gasoline and naphtha were mostly considered waste products and were thereby allowed to “weather”, before the kerosene was recovered. Sometimes refiners burned the light materials in pits or just dumped them. But it did not take long for them to realize that the heavier parts of crude oil could be used as fuel oil for raising steam and heating buildings.[7]

For three decades the refining process consisted of separating these various products by batch processing, monotonously handling one tank of crude at a time. Batch processing operations consisted essentially of a tank where the oil was heated and vaporized and a condenser where the vapours were returned to liquid state. In the beginning of the 20th century, refiners connected these tanks in series and used a so called continuous batch process, which was still an energy intensive and expensive way to do separation. Fractional distillation did not come into widespread use for another two decades. As this technique had already been in use to distil alcohols, the Prohibition Act of 1920 allowed out-of-work technologists from the spirits industry to venture in the petroleum refining sector. The effect was an increase of the separating efficiency by 25%.

The early stage of the petroleum boom is marked by one name – John D. Rockefeller. With his “Standard Oil” Company, founded in 1870 in Ohio, Rockefeller became the prototype of an industrial emperor. “Standard Oil” began to grow rapidly, both horizontally and vertically. It

[6] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 127.
[7] William L. Leffler, *Petroleum refining in nontechnical language,* 4th ed. (Tulsa, Okla: PennWell, 2008), p. 1.

created its own pipelines, tank cars, and logistical networks. By 1880, according to the New York World, “Standard Oil” was “the most cruel, impudent, pitiless, and grasping monopoly that ever fastened upon a country”. That was due to the fact that its share of world oil refining topped out above 90%, but eventually dropped down slowly to 80% because of new oil discoveries in the rest of the world. Over time new foreign competitors eroded his dominance. Rockefeller decided to order the insurance of certificates against oil, which was stored in the pipelines. These certificates became traded by speculators, thus creating the first oil-futures market, which effectively set the spot market price from then on. The National Petroleum Exchange opened in Manhattan in late 1882 to enable the oil futures trading.[8]

In 1904, “Standard Oil” controlled 91% of production and 85% of final sales. This is why the federal Commissioner of Corporations concluded that “beyond question... the dominant position of the Standard Oil Company in the refining industry was due to unfair practices – to abuse of the control of pipe-lines, to railroad discriminations, and to unfair methods of competition in the sale of the refined petroleum products”.

In 1909, the US Department of Justice sued “Standard” under federal anti-trust law, the Sherman Antitrust Act of 1890, for sustaining monopoly and restraining interstate commerce. On May 15, 1911 the US Supreme Court declared the Standard Oil Group to be an “unreasonable” monopoly. It ordered “Standard” to break up into 34 independent companies with different boards of directors. Some of the successor companies include: Exxon (Esso), Mobil, Chevron, and Conoco.[9]

The major event that made refiners change their refining profile was the introduction of the first automobiles to the market, since internal combustion engines needed a light fuel - gasoline. Famous inventors like Karl Benz, Dave Buick, and most of all Henry Ford had a great impact on the petroleum sector. By 1910, some 500.000 cars travelled on the roads of the United States. The demand for gasoline soon exceeded the forecasts, which also led to surpluses of the non-gasoline fractions.

Chemical engineers soon realized they could convert some of the heavier parts of crude by cooking it until it cracked into lighter fractions. Vladimir Shukov patented the thermal cracking process in Russia in 1891, but Amoco brought the first American cracker on steam in 1912 in Chicago. That is considered to be one of the most important breakthroughs in refiner history – namely the cracker.

In 1921, chemists in General Motors discovered that adding small amounts of lead compounds to gasoline considerably improved the octane number. Subsequently engine efficiency improved, but lead emissions polluted the environment until they were prohibited in the 1970s.

Catalysis was introduced by Eugene Houdry in 1936. The first example of a catalytic cracker was with a fixed bed design and doubled the volume of quality gasoline made from heavy feedstocks, as compared to thermal cracking. The first fluidized bed cat cracker was at Esso’s Baton Rouge refinery in 1942.

[8] Wikipedia, “John D. Rockefeller - Wikipedia, the free encyclopedia,” 2012, http://en.wikipedia.org/w/index.php?oldid=470286675, accessed February 2012.
[9] Wikipedia, “Standard Oil - Wikipedia, the free encyclopedia,” 2012, http://en.wikipedia.org/w/index.php?oldid=474149756, accessed February 2012.

As the automobile industry continued to demand more and better quality gasoline, in 1949 the first catalytic reformer started up in Michigan. It improved the octane number of the naphtha already being blended into gasoline.

Hydroprocessing became increasingly important in the second half of the 20th century. Hydrotreating was used to remove contaminants, because of demands to preserve the environment. The origins of hydrocracking lie in the problematic of dealing with the rising supplies of middle distillates (heating oil, diesel, and kerosene), which were over-produced due to massive gasoline demands. The above technology could convert one into another, becoming a perfect solution to this product imbalance.

At the end, refiners resolved the problem of coking in thermal crackers by delaying it until it could take place in a vessel where the coke could be collected – the coke drum. As environmental regulations and growing crude runs pushed down the relative value of residual fuel, refiners had to build more cokers to eliminate the bottom of the distillation process from their portfolios.[10]

### 3.1.2 The Distillation Process

Distillation (refining) is the process were crude oil is separated into various components. It starts with simple distillation, where crude is separated into fractions by boiling it at progressively higher temperatures. Because each component will boil at slightly different temperatures, the systematic increase in temperature will cause products to progressively boil off. These gases are therefore caught and brought back into liquid state.

After this first step of distillation, most refiners process the heavier fractions in order to increase their value. This is because lighter petroleum products (like gasoline and jet) are more valuable than the heavier products (like asphalt, bitumen). By splitting the heavier fractions into simple products, their value is increased. This is also called the downstream processing. Its main purposes are to remove sulphur from oil products and to increase the octane number of gasoline. Downstream processing can substantially increase the light product output of a refinery.[11]

According to Leffler (2008), the five basic refining processes are:[12]

- **Separation** Either by distillation or absorption. The molecules remain intact and no chemistry takes place
- **Cracking** This process uses catalysis, with or without hydrogen, to break apart large molecules into smaller ones. Examples are cat cracking, hydrocracking, and coking.
- **Reshaping** It changes the configuration of individual molecules, as in cat reforming and isomerisation.
- **Combining** It makes larger molecules from smaller ones so they could be used in gasoline, as in alkylation and polymerization.

[10] William L. Leffler, *Petroleum refining in nontechnical language,* 4th ed. (Tulsa, Okla: PennWell, 2008), pp. 3–4.
[11] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 131.
[12] William L. Leffler, *Petroleum refining in nontechnical language,* 4th ed. (Tulsa, Okla: PennWell, 2008), p. 4.

- **Treating** This process uses catalysts and hydrogen to chemically remove contaminants (like sulphur).

Only the first process has no chemistry associated with it. The same molecules that go in are the same that come out. They just end in different buckets or tanks. The rest of the processes are all about chemistry. As they are vital for refineries to remain competitive on a global level, it is important to note that they require massive investments.

As different products boil at different temperatures, it is crucial to a refiner to set the precise cut points in order to fully separate the fractions. The product disposition and the corresponding treatment can be seen in the following figure.

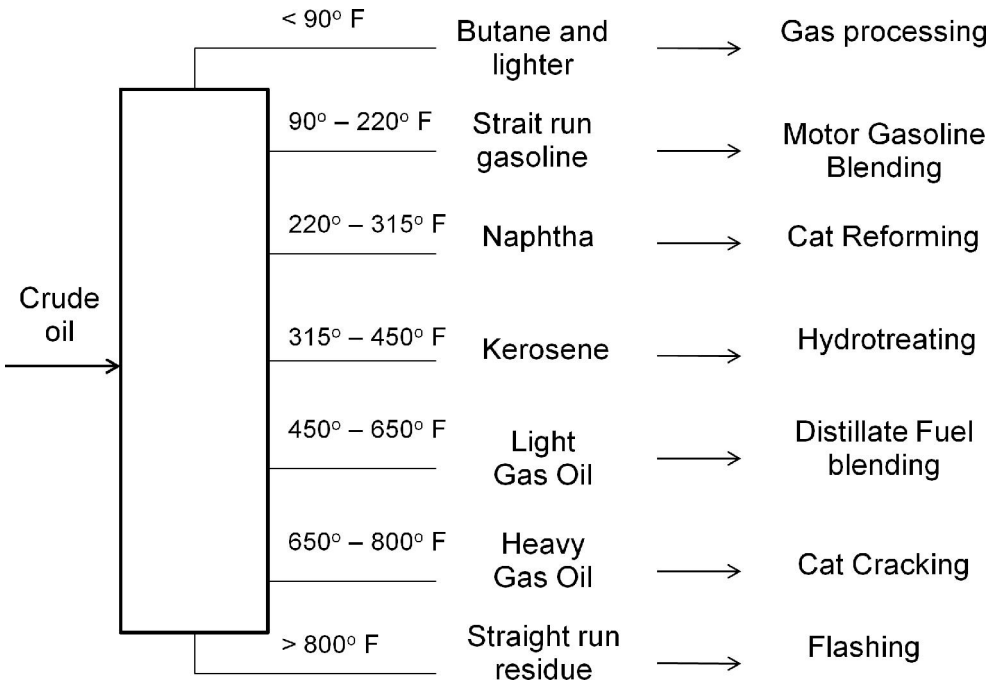



**Figure 2 Distilling crude and product disposition**[13]

Because the raw material (crude) varies around the world, refining towers are often suited for just one type (Brent, WTI, Bonny Light, etc.). Crude oils are typically described by their density and sulphur contents.

Density is commonly measured by API gravity. Low density, or light, crudes contain a higher ratio of light hydrocarbons, which can be recovered through simple distillation. On the other side, heavy crudes have bigger portions of low value products that call for additional processing. The density can also be visually determined. Light crude oils will flow freely, while heavier are more viscous.

High sulphur contents is highly undesirable for crude oils, as sulphur is a major pollutant and can only be removed by expensive processing. Sweet crudes contain low sulphur contents, while sour crude oils have considerably higher sulphur amount.[14]

[13] Ibid., p. 36.
[14] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 129.

### 3.1.3 Physical Oil Products

There is a large difference between the markets of crude oil and that for the refined products like gasoline and diesel. Crude oil has a global market. As it is extracted in certain geographic areas, it has to be transported around the world to a refinery. Crude oil is approximately the same product and has just about the same price wherever it is traded. If, for example, the price of oil in New York is higher than in Hamburg, tanker ships will be diverted from Germany and head to New York.

On the other hand, refined products have typically regional markets. Prices and products formulations vary substantially between regions. In the course of history it was been considered very risky to locate refineries outside the industrialized countries. As a result, finished products are refined close to their final destination. Local environmental regulations further fragment the market. For example, gasoline used in North America is required to use a different formulation than gasoline used in Europe.[15]

The way finished products are derived from crude oil in a refinery can be observed in the next figure.

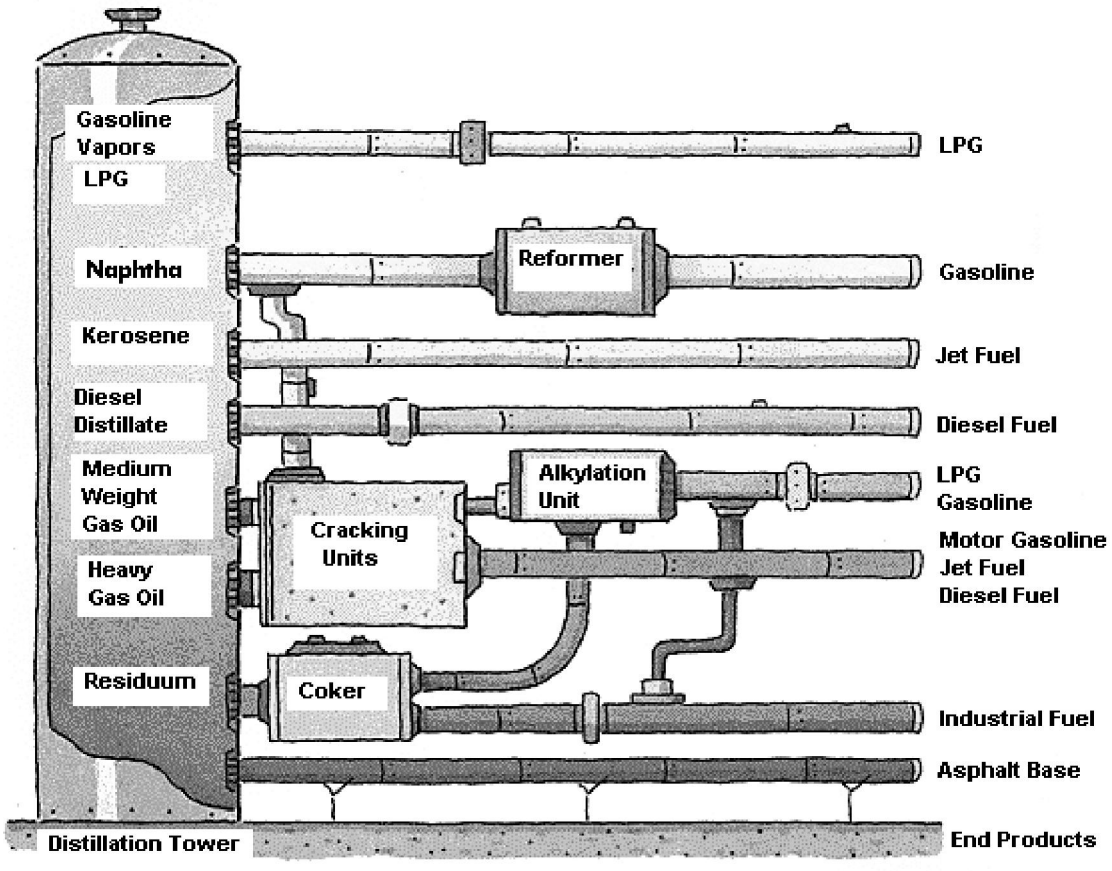



**Figure 3 Simplified drawing of a distillation tower used to separate crude oil into saleable products[16]**

These end products vary in parameters like boiling point, cloud point, pour point, flash point, colour, viscosity, and density. This is why their common fields of use may not be interchanged.

[15] Ibid., pp. 133–134.
[16] "EIA Energy Kids - Oil (petroleum)," http://www.eia.gov/kids/energy.cfm?page=oil_home-basics, accessed January 2012.

**Gasoline**

Gasoline (or petrol, or benzin) is the primary fuel for automobiles in the world. It is also a seasonal product. The demand for gasoline usually increases during periods of good weather. Demand starts to rise in late spring and peaks in summer, which most of the time coincides with the vacation season in Europe.

As gasoline is produced in refineries near industrialized areas, the primary method of distribution is through pipelines. At local terminals, gasoline is mixed with additives to meet the local regulations. After that, it is transported by tanker trucks to local gas station, where it reaches the last stage of its lifecycle. The price of gasoline depends on its octane number, formulation, local taxes, transportation costs, and the marketing plan of the individual gas station owner. But it is also closely linked with crude oil prices and customer demand.

Octane is **not** a measure for energy contents, but a measure of how much gasoline resists ignition. When gasoline resists ignition, less power is delivered to the power train of the car. The result is that energy will not be wasted as heat. For example, due to worldwide environmental politics, bio-components like ethanol should be mixed with gasoline. Ethanol has a higher octane than gasoline (easier to ignite), but it contains less energy. Therefore, adding ethanol to gasoline increases the octane number, but decreases the total distance that can be travelled.

The formulation of fuels refers to a variety of additives that are required or prohibited. That can be the percentage of ethanol to be mixed with gasoline. Another example is the use of lead as an antiknock agent in the past. Antiknock agents are used to increase the octane number. But as lead pollutions from automobile exhaust became a major danger for health and environment, its use was banned.[17]

**Distillate Fuels**

Distillate fuels include kerosene, jet fuel, diesel fuel, and heating oil. Most of the hydrocarbons that boil between 350$^{o}$ F and 800$^{o}$ F and that are not cracked into gasoline blending end up as one of these fuels.[18]

***Kerosene and Jet Fuel***

Kerosene was the favourite fuel for lightning, cooking, and heating in the early oil era. Its main advantages were the plain transportation in cans, drums, or trucks and its easy ignition. The rise of “Standard Oil” was mainly due to the marketing and refining of kerosene, which later became famous for “lighting the lamps of China.”

Kerosene is the cut between naphtha and gas oil, but its actual boiling range can lay within both fractions – commonly from 350$^{o}$ F and 600$^{o}$ F. Its production depends on whether the refiner has a market for lighter or heavier end of the cut.

Commercial aviation fuels, like jet, are hardly more than hydro-treated kerosene. But due to the sensitive field of use of this product, like 35.000 foot, the specifications are considerably stricter. Jet fuels have a boiling point specification of 205$^{o}$ C to 300$^{o}$ C. Other requirements

[17] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), pp. 134–135.
[18] William L. Leffler, *Petroleum refining in nontechnical language,* 4th ed. (Tulsa, Okla: PennWell, 2008), p. 147.

are freeze point at -40$^{o}$ C, smoke point, and the aromatics contents. The smoke point and the aromatics contents are related to each other. Kerosene with a high aromatics level smokes sooner.

Military jet fuel has a lower recovery point to allow more naphtha cut. One of the reasons for this is to allow domestic refineries to provide more of this fuel in times of emergency. Many countries have also abandoned the use of jet fuels like JP-4 because of JP-8 due to the higher flash point specification. This makes the fuel safer to handle.[19]

The only sector that was struck by the crisis in 2008 was that of aviation. The consumption of jet fuel in the USA fell by over 10% and was followed by cuts in the flights of all major airlines. Continental, for example, reduced its flights by almost 15%. As jet fuel represents less than 10% of the total oil demand, it is not a major factor in determining crude oil prices. But the reduction in jet consumption had an impact on the winter gasoil market, because kerosene is used for mixing with gasoil to improve its quality.[20]

***Heating Oil and Diesel Fuel***

There are six grades of fuel oils, which are more or less related to their cut points and fields of applications. Variations of Heating Oil Number 2 are also known as Gasoil in Europe and Heizöl in Germany.[21]

- Number 1 oil sometimes called stove oil, white oil, or just kerosene, is used for lighting, heating, and cooking.
- Number 2 oil, in the light gas oil range, is used as domestic heating oil but cannot easily be vaporized and used for lighting.
- Number 3 oil - was an intermediate grade and it exists no more.
- Number 4 oil is a mixture of light gas oil and heavy gas oil. It is used in marine diesel engines and as industrial fuel oil.
- Number 5 oil is an industrial fuel oil and marine diesel fuel that has to be heated to move and burn it. It can also be used as road oil.
- Number 6 oil is a residual fuel oil used in industrial boilers and power plants and in ships' boilers as bunker fuel. It has to be heated in order to be moved and burned, too.

For safety reasons, each of these fuels has its own flash point specification. This is the temperature, at which the fuels begin to give off enough vapours to form a combustible mixture. It is a common misunderstanding that liquids burn. In fact it is the vapours that pose the substantial threat.

Other specifications include sulphur contents, metals contents, viscosity, and sediment contents.

As Gasoil is mainly used for domestic heating, there is greater demand for it in winter. Both The USA and Europe need to import huge quantities of gasoil during the cold months. The

[19] Ibid., pp. 147–148.
[20] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), p. 24.
[21] William L. Leffler, *Petroleum refining in nontechnical language,* 4th ed. (Tulsa, Okla: PennWell, 2008), pp. 148–150.

countries that can supply this fuel in excess, in relation to their own domestic consumption, are Russia and the Persian Gulf nations. But the quality of gasoil does not usually meet the requirements set by the western countries. This means that it has to be taken to a refinery to be desulphurized or to be blended with other products.

The price of gasoil in winter is closely related to the weather conditions. If for example the winter is mild, the demand will not be that high. But if the temperatures are low for a long period of time, the demand for high-quality gasoil will be great. This is why some households decide to purchase their heating oil in summer, when the prices are not high. In the cold winter months of 2008-2009 in Germany, the thermometer was the main factor for the determination of not only gasoil prices, but crude oil prices too.[22]

Diesel fuel and Heating oil are both variations of the No. 2 Fuel Oil. Whereby diesel has stricter requirements for a minimum pentane/cetane rating (similar to octane for gasoline) and has lower sulphur contents. Otherwise, both products are almost chemically identical and can be interchanged on the financial markets. About 80 percent of No. 2 Fuel Oil is used as diesel fuel.[23]

**Residual Fuels**

These are the leftovers from the bottoms of the refining process, which are not run through residue reduction capacities like cockers. The residue generally returns less money per barrel than the crude oil costs. The basic component is flasher bottoms, which are too viscous to market. Sometimes the refiner will dilute the flasher bottoms with cutter stock, like cat-cracked heavy gasoil or heavy cracked steams that might otherwise go to a hydrocracker. But like many other petroleum products, it all depends on the market demand.

The traditional use for residual fuels has been **boiler fuel**, the simplest way to burn hydrocarbons. This fuel is heated and then sprayed through a specially designed burner tip or nozzle into the firebox section of a boiler. There, the constant fire vaporizes the fuel droplets, igniting them instantly. A system of tubes brings in water, which is heated to steam. The steam is then directed into electricity generators, ships' propulsion turbines, or another unit to use the energy.

Eventually engineers developed diesel engines that could use the cheaper residual fuels. Diesels have the advantage over steam boilers as they are more energy efficient. **Marine diesel fuels** have many grades, depending on the market or supplier. They fall into three groups:

- Marine diesel, which is similar to automotive diesel but may have a lower cetane number and other unsatisfying specification.
- Heavy marine diesel, which is residual fuel.
- Intermediate marine diesel, which is a blend of the two above. Sometimes it is called No. 4 Oil.

[22] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 24–25.
[23] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 137.

Marine diesel engines can be the size of a house. Many of these enormous machines have 8-12 pistons and cylinders 2-3 feet in diameter, with strokes 5-8 feet long. Due to the fact that the fuel burns more slowly, these engines work at much slower rates than automobile diesels.

Depending on where residual fuel is combusted, emissions regulations can determine the maximum sulphur contents of the fuel. A power plant, for example, may require a maximum of 0.1% to 0.5% sulphur. On the other hand, a ship at sea may be able to burn 5% sulphur residue, but probably not in port.

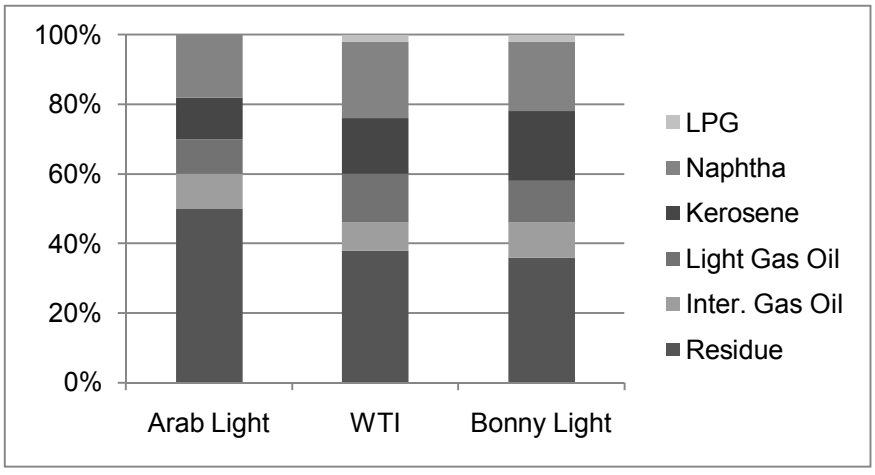
Flasher bottoms usually have the highest concentration of sulphur and metals from all the fractions coming from crude oil. As lighter diluents have to be added to the flasher bottoms to improve parameters like viscosity and pour point, the entire refining process is getting more complicated and cost intensive. Residual fuels tend to be a garbage dump because flash point often limits some components from being blended.[24]

### 3.1.4 Crack Spreads

A crack spread is the difference between the price of finished petroleum products and the price of crude oil. Because most refined products usually remain in their refining region, crack spreads will be different throughout the world. Each region will have its own crack spread set by the supply and demand predictions of its local market for finished petroleum products.

The crack spread is the wholesale price of the refined petroleum products minus the cost of the raw materials. Therefore it is approximately equal to the gross profit that a refiner would earn by converting crude oil into saleable products. If the spreads are too narrow, refiners will reduce the production until the price of the finished products would rise.

Each region has a usual grade of crude oil used as a benchmark. In North America it is West Texas Intermediate, and in Europe – Brent. Different types of crude vary in composition. Premium crude oils will produce a higher percentage of the lightest gasoline-like products through distillation compared to less desirable crudes. As a result, refiners must optimize the mixture of crude oil feed in order to produce the most profitable mix of finished products.[25]




[24] William L. Leffler, *Petroleum refining in nontechnical language,* 4th ed. (Tulsa, Okla: PennWell, 2008), pp. 153–155.
[25] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), pp. 138–139.

**Figure 4 Product yield from simple distillation**[26]

The above figure presents the typical mix of fractions by distillation. Starting top-down, the fractions are: LPG, Naphtha, Kerosene, Light Gas Oil, Intermediate Gas Oil, and Residue.

The end product breakdown from a barrel of crude oil (WTI) can be seen in the next figure.

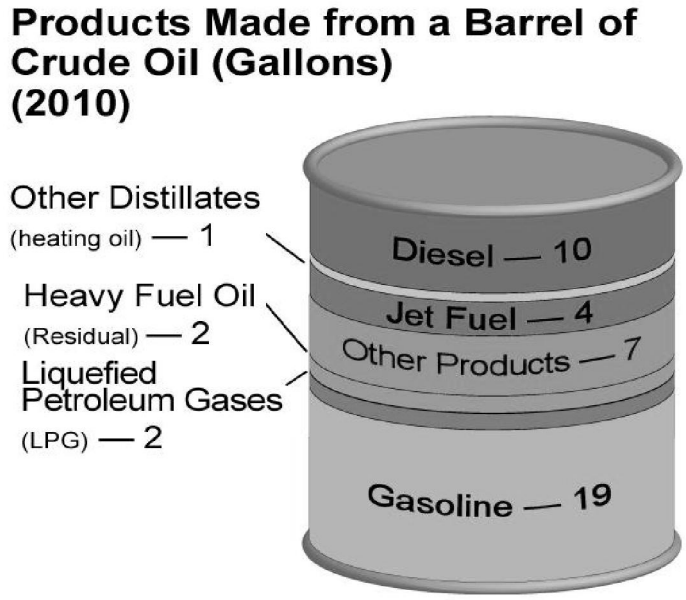



**Figure 5 Approximate mix of products made from one barrel of crude oil**[27]

This figure also aims to show that it is impossible to produce just one distilled product (for example gasoline). The process of distillation involves creating every refined product at the same time. This means that if a refiner needs to produce more gasoline, he will have to produce more diesel fuel. Thereby cost-carrying factors like storage capacity must come into account. If a refiner has no market for an over-produced end product, he will face high storage charges.

A common price risk insurance way for refiners (hedging) is to enter crack spread contracts. This has to be done, because there is a considerable price risk in the timeframe they buy crude oil and they sell the end products. Since the major oil products are traded on exchanges, it is not difficult to make crack trades. The usual spread trades are based on crude oil, gasoline (RBOB), and diesel fuel (Heating Oil). The ratio between these three products defines the crack trade.[28]

### 3.1.5 Evolution of gasoline and diesel fuel

The evolution of the prices of gasoline and diesel in the last decade is mainly due to the environmental regulations posed by governments. The event that sparked the debate over

[26] U.S. EIA, "Simple Distillation," 2006, http://www.eia.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/ref_image_simple.htm, accessed January 2012.
[27] Ibid.
[28] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), pp. 138–139.

the ecological problems was the Chernobyl accident in 1986. The legislative process that followed imposed a change in fuel specifications, in particular for automotive fuels.[29]

The consequences of Chernobyl highlighted certain trends in the oil sector.

- An increase in world oil consumption (partly due to uncertainty regarding nuclear power).
- A tightening of environmental specifications for all fuels, with grim effects on those for the automobile sector.
- A growing inadequacy of the world refining system concerning the changes that had taken place.

The main decisions were to ban or limit contaminating substances like lead or sulphur and to intervene regarding the molecular composition of hydrocarbons used in fuels.

The evolution of gasoline and gasoil specifications in Europe and the USA can be found in the following two tables.

**Table 1 Evolution of gasoline specifications[30]**

| Year | Aromatics | | Olephines | | Benzene | | Sulphur | |
|---|---|---|---|---|---|---|---|---|
| | Europe % | USA % | Europe % | USA % | Europe % | USA % | Europe ppm | USA ppm |
| 1995 | | | | | 5 | | 1000/500 | 320 |
| 2000 | 42 | 45 | 18 | 18 | 1 | 4 | 150 | 150 |
| 2005 | 35 | 35 | 18 | 18 | 1 | 1 | 50 (10) | 30 |
| 2010 | 35 | 25 | 18 | 6 | 1 | 1 | 10 | 10 |

**Table 2 Evolution of diesel specifications[31]**

| Year | Poliaromatics | | Sulphur | | Density | |
|---|---|---|---|---|---|---|
| | Europe % | USA % | Europe ppm | USA ppm | Europe $kg/m^3$ | USA $kg/m^3$ |
| 1995 | | | 2000/500 | 5000 | 820-860 | |
| 2000 | 11 | 11 | 350 | 500 | 820-845 | |
| 2005 | 11 | 11 | 50/10 | 15/50 | 820-845 | |
| 2010 | 8 (6) | | 10 | 15 | 820-845 | |

Above all, it is the pursuit of sulphur reduction that has changed the market for automotive fuels. With the Euro norms, both gasoline and diesel have seen a fall in sulphur contents from 500 ppm (Euro 2) to 10 ppm (Euro 5). However, these changes have forced refineries to adapt their refining process to the evolution of these specifications. The result is that for the new higher-quality products to be made, large investments and internal process

[29] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 44–49.
[30] Ibid., p. 46.
[31] Ibid., p. 47.

reorganization have to take place. This, among all, has had a great impact on the price of the final product.

The factor that has the greatest impact on the price of the finished product at the gas station is the taxation policy of the separate government. Taxes in Europe are considerably higher than taxes in the USA. This explains the paradoxical difference between prices of both diesel and gasoline between the two continents. The taxation on gasoline in Europe represents around 60% of the retail price and about 136% of the market price. In the USA, on the other hand, it is only 13% of the retail price and 15% of the market price.

In Italy, for example, one of the most important Mediterranean refining countries and a gasoline exporter, the prices of gasoline are higher than those in the USA, which is responsible for about 50% of the world gasoline consumption. Although the USA's gasoline consumption is about 30 times greater than that in Italy, the tax revenue in America from automobile fuels is three times lower.[32]

The pre-tax and retail prices of gasoline and diesel in all 27 EU member countries can be seen in the following table. All prices are in Euro/litre.

**Table 3 Pre-tax and retail prices for gasoline and diesel in Europe[33]**

| February, 2012 | Unleaded (Superbleifrei, Euro95) | | | | | Diesel (Gazole, Gasóleo) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | FOB | Margin | Excise duties | VAT | Retail price | FOB | Margin | Excise duties | VAT | Retail price |
| Austria | 0.551 | 0.085 | 0.506 | 0.229 | 1.371 | 0.601 | 0.127 | 0.422 | 0.230 | 1.380 |
| Belgium | 0.543 | 0.188 | 0.647 | 0.289 | 1.667 | 0.593 | 0.194 | 0.451 | 0.260 | 1.498 |
| Bulgaria | 0.546 | 0.214 | 0.310 | 0.214 | 1.284 | 0.561 | 0.244 | 0.325 | 0.226 | 1.356 |
| Cyprus | 0.551 | 0.157 | 0.401 | 0.166 | 1.276 | 0.551 | 0.252 | 0.338 | 0.171 | 1.313 |
| Czech Republic | 0.556 | 0.129 | 0.528 | 0.243 | 1.456 | 0.556 | 0.225 | 0.452 | 0.247 | 1.480 |
| Denmark | 0.546 | 0.203 | 0.639 | 0.347 | 1.734 | 0.546 | 0.237 | 0.483 | 0.316 | 1.582 |
| Estonia | 0.546 | 0.135 | 0.452 | 0.227 | 1.360 | 0.546 | 0.232 | 0.385 | 0.233 | 1.395 |
| Finland | 0.556 | 0.149 | 0.602 | 0.301 | 1.608 | 0.556 | 0.357 | 0.349 | 0.290 | 1.552 |
| France | 0.551 | 0.137 | 0.667 | 0.266 | 1.621 | 0.551 | 0.195 | 0.390 | 0.223 | 1.359 |
| Germany | 0.546 | 0.136 | 0.649 | 0.253 | 1.584 | 0.546 | 0.211 | 0.470 | 0.233 | 1.460 |
| Greece | 0.556 | 0.155 | 0.682 | 0.321 | 1.714 | 0.556 | 0.277 | 0.421 | 0.288 | 1.542 |
| Hungary | 0.561 | 0.145 | 0.429 | 0.306 | 1.441 | 0.561 | 0.241 | 0.384 | 0.320 | 1.506 |
| Ireland | 0.561 | 0.071 | 0.634 | 0.291 | 1.558 | 0.561 | 0.159 | 0.529 | 0.287 | 1.536 |
| Italy | 0.556 | 0.155 | 0.720 | 0.301 | 1.732 | 0.556 | 0.245 | 0.581 | 0.290 | 1.672 |
| Latvia | 0.551 | 0.138 | 0.418 | 0.244 | 1.351 | 0.551 | 0.226 | 0.334 | 0.244 | 1.355 |
| Lithuania | 0.556 | 0.128 | 0.434 | 0.235 | 1.352 | 0.556 | 0.237 | 0.296 | 0.229 | 1.318 |
| Luxembourg | 0.551 | 0.153 | 0.476 | 0.177 | 1.357 | 0.551 | 0.208 | 0.314 | 0.161 | 1.234 |
| Malta | 0.561 | 0.165 | 0.469 | 0.215 | 1.410 | 0.561 | 0.192 | 0.365 | 0.201 | 1.320 |
| Netherlands | 0.546 | 0.143 | 0.778 | 0.279 | 1.745 | 0.546 | 0.221 | 0.464 | 0.234 | 1.465 |
| Poland | 0.551 | 0.123 | 0.406 | 0.249 | 1.329 | 0.551 | 0.207 | 0.359 | 0.257 | 1.374 |
| Portugal | 0.556 | 0.163 | 0.620 | 0.308 | 1.647 | 0.556 | 0.257 | 0.406 | 0.280 | 1.500 |
| Romania | 0.546 | 0.113 | 0.378 | 0.249 | 1.286 | 0.546 | 0.206 | 0.322 | 0.258 | 1.332 |
| Slovakia | 0.551 | 0.105 | 0.586 | 0.248 | 1.490 | 0.551 | 0.221 | 0.419 | 0.238 | 1.429 |
| Slovenia | 0.551 | 0.104 | 0.516 | 0.234 | 1.406 | 0.551 | 0.172 | 0.380 | 0.221 | 1.324 |
| Spain | 0.556 | 0.160 | 0.448 | 0.209 | 1.373 | 0.556 | 0.225 | 0.343 | 0.202 | 1.326 |
| Sweden | 0.551 | 0.130 | 0.643 | 0.331 | 1.654 | 0.551 | 0.220 | 0.549 | 0.330 | 1.649 |
| United Kingdom | 0.546 | 0.094 | 0.732 | 0.274 | 1.646 | 0.546 | 0.177 | 0.740 | 0.293 | 1.755 |

[32] Ibid., pp. 57–62.
[33] Europe's Energy Portal, "Europe's Energy Portal » Fuel Prices, Rates for Power & Natural Gas," http://www.energy.eu/#fueltaxes, accessed February 2012.

It is interesting to point the retail price formation in Bulgaria. Although the VAT and the excise duties imposed by the Bulgarian government are among the lowest in Europe, the refining/ profit margin counts to the highest on the continent. Another interesting point is that the FOB (Free on Board) prices are nearly the same around Europe. This leads to the conclusion that the Bulgarian local market can be attractive to some energy traders.

Finally, the factor that has the greatest impact on finished oil products is the innate volatility of petroleum as a whole. This can be clearly seen in the next figure, where the EU-average price movements of diesel and gasoline are presented.

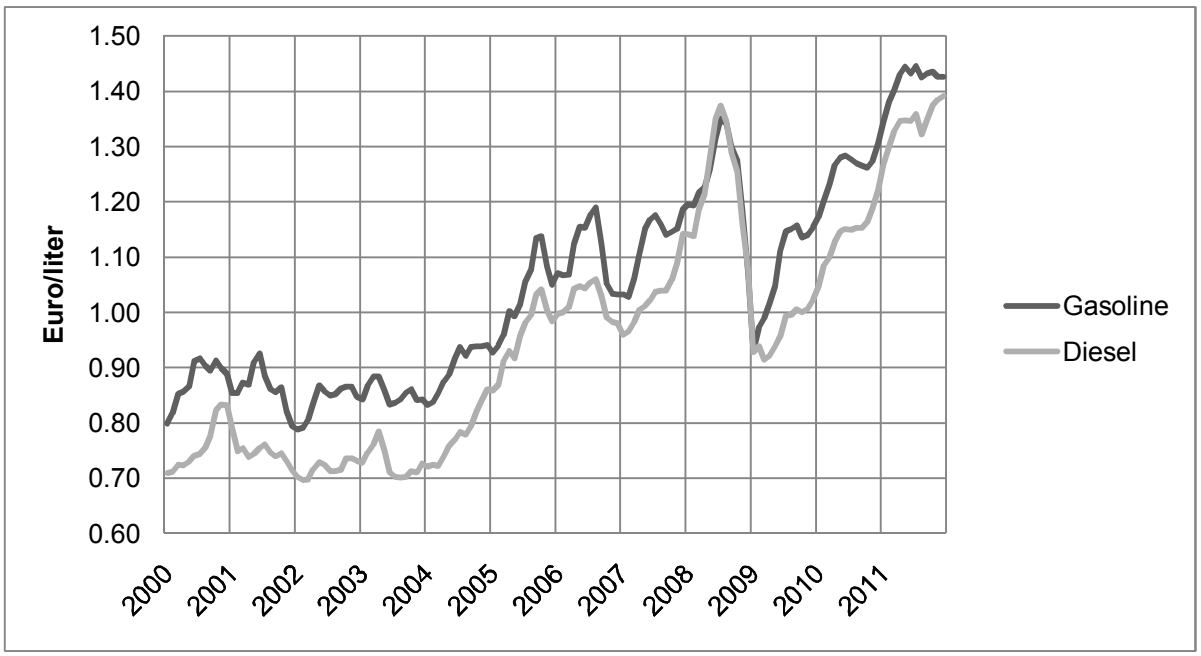



**Figure 6 Retail prices of diesel and gasoline EU-average 2000-2011**[34]

Because the excise duties of gasoline are higher than those of diesel (Table 3) it is natural that gasoline should be more expensive. But if we go back to the Financial Crisis that started in 2008, the events that have led to an increase of the Brent benchmark have also influenced the diesel/gasoline price relationship.

A look in the chart in Figure 6 shows that in the summer of 2008 the prices of diesel were higher than the prices of gasoline. As there were no cold months, there was no need of gasoil/diesel fractions to be used for heating purposes. This was also the so called “vacation season”, when gasoline prices are usually at their peak. An explanation to this obscure phenomenon can be found once again in the financial sector. Apart from crude oil futures, the other major energy futures that are traded at commodity exchanges are the Gasoil (ICE) and Heating Oil (NYMEX) future contracts. This, therefore, has had the same dramatic impact on diesel/gasoil prices as on crude oil. When there is price volatility, there is speculating and hedging.

### 3.1.6 The Energy Cycle

The energy cycle of petroleum depicts the steps that take place from the point of extraction, all the way to the gas tank of a vehicle or burner. The main steps are:

[34] Ibid.

- searching, development and extraction of crude oil
- storage and transportation of crude oil to a refinery
- distillation and petroleum product disposition
- storage and transportation to the end user or a local distributor
- eventual processing by the local distributor like blending with bio-components or colouring; followed by transportation to the end consumer
- burning of the finished petroleum product

Extracting crude oil is not the same around the world. Crude oils vary according to their geographical location in composition and distillation curve. The major premium grades are Brent, WTI, Arab Light, and Bonny Light. However, as the demand for petroleum increases, new sources have to be developed and operated. Above all are underwater deposits of crude oil in the North Sea and the Gulf of Mexico that are driving the extraction costs in the sky. Deepwater rigs require large investments (hundreds of millions of USD), which must repay themselves on the long run.

But sometimes things can go wrong very fast. This is what happened to BP (British Petroleum) and their deepwater rig "Deepwater Horizon" in 2010. The natural disaster that was caused by the explosion of the oil rig and the resulting oil spill forced the company to pay billions of USD in the form of compensations. The news and papers worldwide were filled with information about this event, having a severe impact on the image of BP.

**Table 4 Total production costs by region**[35]

| Region | 2003-2005 | 2004-2006 |
|---|---|---|
| | $/bbl | $/bbl |
| USA | | |
| Onshore | 14.00 | 19.46 |
| Offshore | 50.56 | 69.75 |
| Total USA | 16.70 | 23.16 |
| Canada | 23.84 | 26.59 |
| Europe | 16.43 | 29.79 |
| Africa | 22.26 | 32.13 |
| Middle East | 9.78 | 14.31 |
| **Worldwide** | **17.45** | **24.29** |

With production costs rising constantly, it is natural for petroleum to climb the price charts. As crude oil reserves are predicted to deplete in the near future, more cost intensive fields must be developed in order to meet the required demand. Potential oil reserves underneath the ice of the Arctic Circle are just some of the possible solutions that can be developed in the next decades.

After extraction, crude oil is collected through pipelines or vessels in an oil terminal. From there it can be loaded on ships or directed straight to a refinery via pipelines. Major oil terminal are in Cushing, Oklahoma, and in Sullom Voe, Shetland Islands. This is actually the point, where petroleum begins to be traded. The supply and demand laws are the ones that determine the route of the oil tankers.

[35] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), p. 19.

Once at a refinery, crude oil is processed to finished or semi-finished products. Because most refineries are situated near industrialized areas, the local market influences the product mix that leaves the distillation tower. Usually some over-produced quantities are loaded on ships or trucks and are then dispatched to nearby markets. Whereby, distance is an important price formation factor.

As petroleum and petroleum products are used around the globe, many intermediaries join the energy cycle. These are mainly trading companies and storage operators. The large network, required to move all of the oil products, can barely be handled by just the refining companies. Also, antimonopoly regulations force the branching of the market. The above mentioned intermediaries can sell the product directly to the end consumer (at a gas station) or will need to process it further by mixing it with additives or bio fuels.

Petroleum ends its cycle most of the time with the burning in a vehicle's tank or in an industrial boiler. There, one of the main characteristics of oil – namely emissions, arranges for numerous debates around the world. Environmental regulations have had severe impact on the price and chemical properties of the two major vehicle fuels – gasoline and diesel. In recent years, the automotive sector has also altered its future concepts. Low-emission and low-consumption vehicles were the answer to the rising environmental awareness. Also, hybrid technologies and pure electrical cars were introduced.

## 3.2 The Oil Market

### 3.2.1 Introduction

There have been many changes over history that have restructured the oil market to the level it is today. To understand why the financial world has literally taken control of the oil market, a quick look in the past will be helpful.

In the 1960s and up to 1973, the price of crude was fixed by the big oil companies, who had a monopoly on the market. It was usually calculated by the average of the big companies' listed price. This price was the only one published and it reflected the current benchmark – Arabian Light crude. The prices of all the other crudes were established regarding this benchmark. It was a classic situation of monopoly/oligopoly, featuring perfect control of the supply by the producers. That resulted in completely steady prices as they were able to regulate supply according to demand fluctuations.

OPEC (Organization of Petroleum Exporting Countries) was formed in 1960 in Iraq, with the intention of controlling the oil market by improving the coordination between its members. However, the control over the price of oil remained in the hands of the big multinational companies until 1973.

In 1973, with the Yom Kippur war, the first historical upset in the oil market took place. The Arab countries declared an oil embargo on the countries that supported Israel. OPEC used this event to take control of crude prices, with Saudi Arabia as the leading member. Prices were published each year and the only benchmark was Arabian Light. As a result, the crude price rose from the $2 per barrel level to $12-15 per barrel, forming the first great oil crisis.

In 1974, the International Energy Agency (IEA) was created. This was an organization between the main oil consuming countries. Its purpose was to mutually assist one another in

a case of an embargo and to exchange information regarding national oil data. The IEA was in general a research bureau for energy issues.

On 11 November 1976, a new oilfield in the North Sea started production. Soon the first oil tanker left the terminal, making the way for this new crude grade, which was called Brent.

The next years of the oil market history were marked by the seizure of power by Saddam Hussein in Iraq, the revolution in Iran, and the break-out of the Iran-Iraq war in September 1980. In total, the consequence of these events was a trend of oversupply by consumers due to uncertainty, which later turned out to be an overreaction to the expected crude oil shortages. The logistic costs and financial charges, incurred by the rise of crude, remained rather unjustified.

During 1982, oil companies reduced significantly their purchases of crude from OPEC nations, which, on the other hand, continued to propose very aggressive prices. This was the beginning of the gradually decreasing role of OPEC as a price setter. As all the crude was not bought by the oil companies at the official prices, it was sold spot to independent traders at discounted prices. That created two parallel markets – one based on the official price and the other on spot prices. Nevertheless, the producing nations continued to supply the oil market with crude, aiming to collect big profits.

The following years were marked by a weakening of oil prices due to energy diversification. New nuclear plants were built, which reduced the consumption of fuel oil. Also natural gas began to gain positions on the energy market. Refiners were faced with the decision whether they would construct cracking plants to convert fuel oil into gasoline and diesel, or simply shut down.

In August 1985, Sheikh Yamani, the minister of Saudi Arabia, issued a declaration in which he stated that his country will sustain a production level of 5-6 million barrels per day. This was due to the fact that other OPEC members were producing more than previously agreed, thus cutting Saudi Arabia's market share. Later, Yamani announced a crude oil price war against the non-OPEC countries and partly against the OPEC members that continued to ignore the production quotas. Eventually, as a new pricing system was adopted, the free market began to operate. The market dynamics changed from the so-called oligopoly model, which obeyed the classical law that links price to supply, creating a competitive market.

As producing countries and refineries continued to pump crude and finished products on the market, it slowly saturated. In July 1986, Shell UK published the "15 day Brent contract". For the first time the price of crude, Brent, was fixed to a sort of petroleum exchange. At the beginning, only a selected number of professionals could operate there, defining the price level on a daily basis. In a short time it became the reference tool in the London marketplace, where the big companies had their headquarters. Because of the growing complexity, any form of tension in the Middle East or any decision by OPEC had an impact on Brent. Prices started to fall week for week from a level of $30 per barrel down to $11 per barrel. This is described as the oil counter-shock, as the market got full with products. Traders that had bought cargoes of crude just a couple of days earlier faced severe loss due to the low prices they were forced to sell.

In December 1988, OPEC, decided to accept the challenge of the free oil market by accepting the new Brent benchmark. All the crudes produced by the OPEC members were to

be priced with reference to Brent. Since all of the producing nations in OPEC and non-OPEC world used the same benchmark, they could be regarded as the new price cartel. But as there was no agreement to regulate supply to the real needs, there was no way to regulate or control prices. The market had become absolutely free. Anyone could produce as much as he wanted and sell their crude by simply varying the price differential to Brent.

The events that followed in this free oil market vary from wars to significant economical decisions. But the most important event is the so called “divorce between oil price and oil”. It was made possible in 2002, when Saudi Arabia and Iran decided not to refer to the value of the physical Brent Dated, but rather directly use the Brent IPE futures. IPE stands for Interpetroleum Exchange, which is now part of ICE.

The result is, more or less, the free oil market in modern times. Where, for example, hedge funds could purchase massive quantities of Brent futures, hoping to make a profit whether prices go up or down. As there was more demand in this financial market, prices would rise. But this price increase would be reflected among the entire chain, as various types of crudes are using Brent as benchmark.[36]

### 3.2.2 Definition

The oil market has evolved from a mere spot market at the beginning of the oil era to a network of different markets that operate separately and independently, but which are linked by certain complex forms of correlations and dynamics. There is the crude oil market, the one for the raw material. There is also the finished products market like gasoline, diesel, gasoil, jet fuel, fuel oil, lubricants. The newest one is the financial market for crude oil and finished products – futures. The basic difference between the physical and financial worlds lays in the fact that automobiles burn the physical product, not futures.[37]

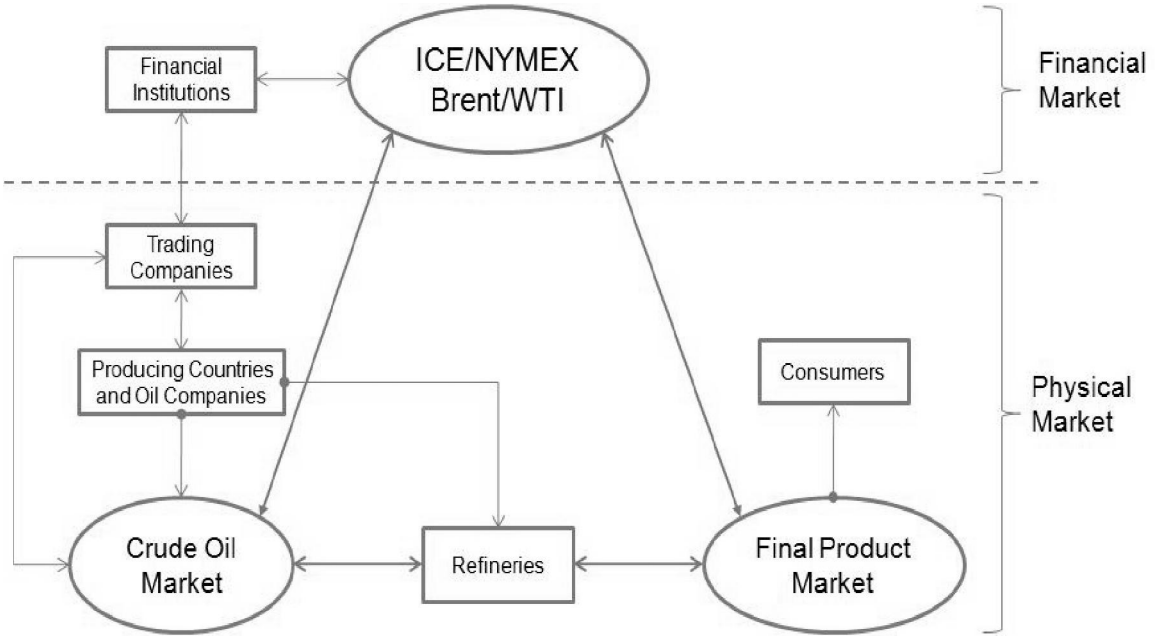



**Figure 7 Complexity and interdependence in the oil market**[38]

[36] Ibid., pp. 30–44.
[37] Ibid., pp. 4–5.
[38] Ibid., p. 4.

Each and all of these markets react to different behaviour patterns and they are run by people with different backgrounds and interests. To create a model that depicts the interrelations between these three markets with their individual dynamics is close to impossible. This means that the possibility to determine the precise oil price in a certain point in the future is most unrealistic.[39]

### 3.2.3 World Oil Flow

This is the section, where the supply and demand on a global level will be discussed. To begin, a look on the expected supply and demand flows can be helpful.

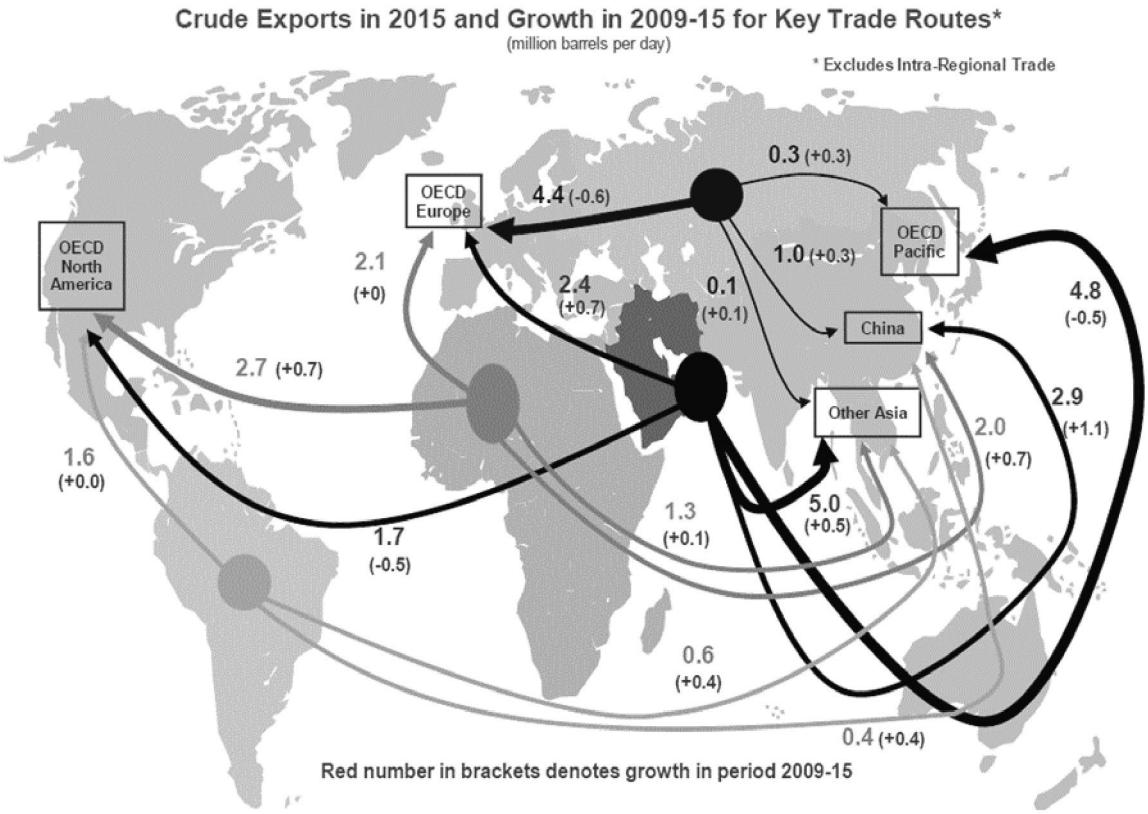



**Figure 8 Expected crude exports flow in 2015**[40]

At first, the main crude oil flows in the world can be seen. The major ones are from the Persian Gulf towards North America, Europe, Japan, and the Asian emerging markets China and India. Other main crude exporting centres are Africa, South America and Russia. Although the United States are among the top producing countries, they still have to import large amounts of crude regularly. Europe, on the other hand, has to purchase crude oil from many centres due to the not sufficient oil reserves underneath the “Old Continent”.

This is the place to also discuss the emerging oil markets in the so called BRIC countries. BRIC is an acronym for Brazil, Russia, India, and China. Russia, as it can be seen in the figure, is one of the top producers in the world. But it is not an OPEC member. It can easily meet its domestic petroleum needs and therefore can export large quantities of crude and oil products to other markets. Also, in winter, Russia has an excess of gasoil, which can be sold

[39] Ibid., pp. 4–5.
[40] International Energy Agency, “Medium Term Oil and Gas Markets Parts 1 and 2,” (2010): 102, accessed July 2012.

in Europe. Brazil's industry is slowly growing, which means that it will have to increase its oil demand to meet the expected rise in consumption.

The same goes to the two Asian giants – China and India. The industrial boom has constantly increased the consumption of petroleum and petroleum products in these two countries. As it can be seen in Figure 8, more crude oil is expected to flow in the direction of China and India in the next years.

The consequence of this on a global level can be the allocation of flows from one production region towards industrially evolving countries. This is most likely to be linked with price fluctuations due to the overall change in supply/demand. Nevertheless, the two most important energy markets remain the USA and Europe, whereby petroleum will continue to be the prime energy product for some time.

The world supply structure can be divided into two segments:[41]

- That of the **guaranteed flows**, which are about 88% of the total volume. This is namely the part of world production that reaches is regular final destination daily, independently of price level.
- That of the **flows dependent on the price**, which represent the rest 12%. They are the production fraction that reaches the final market, which offers the most adequate price.

This, therefore, leaves enough space for manipulation by the big players. By moving only minor quantities, an enormous pressure can be exerted on the balance of the world oil market. Examples for market squeezes that aimed making profit out of disrupted supply of goods can be found in past. One of the first events of this kind was the squeeze of Brent.

To the price dependent sector join also portions of crude flows in the form of repayments for past goods or investments. An approximate maximum of 25% is what actually represents the physical free oil market, dependent on price level. This fragile supply and demand balance can, as a result, be easily upset by financial speculations.

### 3.2.4 Players

The energy cycle of petroleum offers many possibilities for intermediaries to join the market. Besides the regular participants like producing nations, multinational oil companies, and the final consumer, there are sectors of the financial world that have already arranged for surprises on the oil market. The major players will be listed in this part of the thesis.

**Producing Nations**

The producing nations can be separated into two groups – OPEC and non-OPEC members. This division also allows for the balance of the fragile oil market, as monopoly can be theoretically avoided by changing the supplier. Detailed information on supply and demand chains can be found on both the official internet sites of OPEC (www.opec.org) and the IEA (www.iea.org).

[41] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 70–72.

**Table 5 World oil production 2004-2009 in million barrels per day**[42]

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| **OPEC** | | | | | | |
| Crude Oil | | | | | | |
| Saudi Arabia | 8.60 | 9.06 | 8.93 | 8.48 | 8.90 | 7.92 |
| Iran | 3.93 | 3.88 | 3.91 | 3.98 | 3.90 | 3.74 |
| Iraq | 1.99 | 1.81 | 1.90 | 2.09 | 2.38 | 2.43 |
| UAE | 2.35 | 2.46 | 2.62 | 2.52 | 2.59 | 2.27 |
| Kuwait | 2.05 | 2.13 | 2.21 | 2.16 | 2.31 | 2.01 |
| Neutral Zone | 0.60 | 0.58 | 0.58 | 0.56 | 0.57 | 0.54 |
| Qatar | 0.77 | 0.77 | 0.82 | 0.80 | 0.85 | 0.77 |
| Angola | 0.99 | 1.23 | 1.37 | 1.66 | 1.85 | 1.77 |
| Nigeria | 2.32 | 2.40 | 2.24 | 2.13 | 1.95 | 1.82 |
| Libya | 1.55 | 1.64 | 1.71 | 1.71 | 1.72 | 1.55 |
| Algeria | 1.25 | 1.33 | 1.34 | 1.35 | 1.36 | 1.25 |
| Ecuador | 0.53 | 0.53 | 0.54 | 0.50 | 0.50 | 0.47 |
| Venezuela | 2.59 | 2.71 | 2.56 | 2.39 | 2.35 | 2.15 |
| Total Crude Oil | 29.52 | 30.53 | 30.73 | 30.33 | 31.23 | 28.69 |
| NGLs | 3.81 | 4.17 | 4.26 | 4.29 | 4.41 | 4.66 |
| **Total OPEC** | **33.33** | **34.70** | **34.99** | **34.62** | **35.64** | **33.35** |
| **NON-OPEC** | | | | | | |
| **OECD** | | | | | | |
| **North America** | 14.35 | 13.88 | 13.93 | 13.86 | 13.33 | 13.62 |
| United States | 7.43 | 7.07 | 7.06 | 7.06 | 6.92 | 7.44 |
| Mexico | 3.83 | 3.76 | 3.63 | 3.48 | 3.16 | 2.97 |
| Canada | 3.09 | 3.05 | 3.19 | 3.32 | 3.25 | 3.22 |
| **Europe** | 6.11 | 5.66 | 5.27 | 4.98 | 4.75 | 4.52 |
| UK | 2.06 | 1.84 | 1.66 | 1.66 | 1.56 | 1.47 |
| Norway | 3.19 | 2.97 | 2.78 | 2.56 | 2.46 | 2.39 |
| Other | 0.86 | 0.85 | 0.83 | 0.76 | 0.73 | 0.67 |
| **Pacific** | 0.59 | 0.60 | 0.58 | 0.63 | 0.65 | 0.65 |
| Australia | 0.54 | 0.55 | 0.53 | 0.55 | 0.55 | 0.55 |
| Others | 0.05 | 0.05 | 0.05 | 0.08 | 0.10 | 0.10 |
| **Total OECD** | **21.05** | **20.14** | **19.78** | **19.47** | **18.73** | **18.79** |
| **Non-OECD** | | | | | | |
| **Former Soviet Union** | 11.43 | 11.83 | 12.30 | 12.81 | 12.83 | 13.28 |
| Russia | 9.37 | 9.64 | 9.85 | 10.09 | 10.01 | 10.21 |
| Others | 2.06 | 2.20 | 2.45 | 2.73 | 2.81 | 3.07 |
| **Asia** | 7.32 | 7.40 | 7.43 | 7.35 | 7.51 | 7.46 |
| **Europe** | 0.17 | 0.16 | 0.15 | 0.15 | 0.14 | 0.14 |
| **Latin America** | 3.30 | 3.48 | 3.58 | 3.56 | 3.68 | 3.88 |
| **Middle East** | 1.94 | 1.88 | 1.78 | 1.66 | 1.66 | 1.68 |
| **Africa** | 2.47 | 2.49 | 2.54 | 2.63 | 2.66 | 2.61 |
| **Total Non-OECD** | **26.63** | **27.25** | **27.78** | **28.17** | **28.47** | **29.05** |
| **Total Non-OPEC** | **50.18** | **49.98** | **50.50** | **50.89** | **50.92** | **51.71** |
| **Total Supply** | **83.50** | **84.69** | **85.48** | **85.51** | **86.56** | **85.05** |

[42] International Energy Agency, "Annual Statistical Supplement for 2009 [2010 Edition]," (2010): 18, accessed July 2012.

The first conclusion from Table 5 is that the biggest producing countries are correspondingly Russia, Saudi Arabia and the USA. Besides OPEC members, the table is also divided into OECD and Non-OECD countries. OECD stands for Organisation for Economic Co-operation and Development. Furthermore, it is OPEC's share of the total world production by over 30% that has to be pinpointed. Another important fact is that year-to-year production ratios of OPEC members are almost constant, which means that there is actually no intensive shortage of crude oil from their side.

**Table 6 OPEC Members' facts and figures 2010**[43]

| | Population in million | Petroleum exports billion $ | Proven crude reserves billion barrels | Crude oil production 1000 bbl/day | Crude oil exports 1000 bbl/day | Exports oil products 1000bbl/day |
|---|---|---|---|---|---|---|
| Algeria | 36.30 | 57.80 | 12.20 | 1190 | 709 | 314.1 |
| Angola | 19.05 | 49.26 | 9.50 | 1691 | 1,683 | 7.5 |
| Ecuador | 14.31 | 17.37 | 7.21 | 476 | 340 | 28.1 |
| IR Iran | 75.35 | 83.79 | 151.17 | 3544 | 2,583 | 370.6 |
| Iraq | 32.44 | 52.08 | 143.10 | 2358 | 1,890 | 5.0 |
| Kuwait | 3.57 | 65.98 | 101.50 | 2312 | 1,430 | 631.6 |
| Libya | 6.56 | 46.31 | 47.10 | 1487 | 1,118 | 48.3 |
| Nigeria | 159.64 | 70.58 | 37.20 | 2048 | 2,464 | 23.1 |
| Qatar | 1.70 | 72.05 | 25.38 | 733 | 586 | 321.6 |
| Saudi Arabia | 26.11 | 235.34 | 264.52 | 8166 | 6,644 | 950.9 |
| UAE | 4.74 | 198.36 | 97.80 | 2324 | 2,103 | 187.9 |
| Venezuela | 28.95 | 65.79 | 296.50 | 2854 | 1,562 | 751.1 |
| **OPEC** | 408.71 | 1,014.71 | 1,193.18 | 29,183 | 23,112 | 3,640 |

As it can be seen from Table 6, OPEC constitutes of 12 member countries, which are located on three continents. Due to low domestic petroleum consumption, they can easily export crude oil and finished products. Oil trade represents the major income source for the OPEC nations. The total value of petroleum exports, which exceeds one trillion USD per year, and the immense proven crude reserves, are what makes them influential on the oil market.

### Consuming Nations

The constant demand for oil is what is pushing the price of this precious commodity. What characterizes consuming nations is the fact that they need petroleum to meet their domestic industrial needs. Without a doubt, the biggest consumers are the USA, the developed European countries, China, Japan, and India. European countries, as a whole, are also very exposed to oil shortages as they must constantly import petroleum because of the insufficient quantities available. There are two types of commodities that consumers need - either the raw material or the finished/ semi-finished product.

**Table 7 Total world oil supply and demand 2002-2009 in million barrels per day**[44]

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|
| North America | 24.2 | 24.6 | 25.5 | 25.6 | 25.4 | 25.5 | 24.2 | 23.3 |
| OECD Europe | 15.3 | 15.5 | 15.5 | 15.7 | 15.7 | 15.5 | 15.4 | 14.5 |
| China | 5.0 | 5.6 | 6.4 | 6.7 | 7.2 | 7.6 | 7.7 | 8.4 |
| Total World Demand | 78.3 | 79.9 | 82.9 | 84.1 | 85.1 | 86.5 | 86.0 | 84.7 |
| Total World Supply | 77.4 | 80.2 | 83.5 | 84.7 | 85.5 | 85.5 | 85.5 | 85.0 |
| Difference | 0.9 | -0.3 | -0.6 | -0.6 | -0.4 | 1.0 | 0.5 | -0.3 |

[43] OPEC, "Annual Statistical Bulletin: 2010/2011 Edition,": 11.
[44] International Energy Agency, "Annual Statistical Supplement for 2009 [2010 Edition]," (2010): 4, accessed February 2012.

Firstly, the data in the table above may not be completely accurate because of rounding errors, conversion factors, and the scope of work. Secondly, the information collected from some countries may not be complete. Data from Venezuela under Chavez and Iran under Ahmadinejad is also sometimes considered to be not precise enough.

But what can be observed from Table 7 is that the global demand has risen from 2002 till 2009, but so has the supply. The difference reflects the demand minus supply ratio and so it can be seen that there were no major disturbances in the global supply and demand chain. The steady increase in demand from China can partly be blamed for the minor fluctuations in this chain.

**Table 8 USA and OECD Europe product demand 2006-2009 in million barrels per day**[45]

| | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| **United States** | | | | |
| LPG | 2.05 | 2.08 | 1.95 | 2.05 |
| Naphta | 0.36 | 0.33 | 0.29 | 0.25 |
| Motor Gasoline | 9.25 | 9.29 | 8.99 | 9.00 |
| Jet/Kerosine | 1.69 | 1.65 | 1.55 | 1.41 |
| Gasoil | 4.17 | 4.20 | 3.95 | 3.63 |
| Residual Fuel Oil | 0.69 | 0.72 | 0.62 | 0.51 |
| Other Produsts | 2.51 | 2.44 | 2.19 | 1.92 |
| **Total** | 20.69 | 20.68 | 19.50 | 18.77 |
| **OECD Europe** | | | | |
| LPG | 0.99 | 0.99 | 1.02 | 0.92 |
| Naphta | 1.17 | 1.28 | 1.16 | 1.11 |
| Motor Gasoline | 2.57 | 2.48 | 2.36 | 2.29 |
| Jet/Kerosine | 1.27 | 1.30 | 1.32 | 1.27 |
| Gasoil | 6.25 | 6.12 | 6.27 | 6.02 |
| Residual Fuel Oil | 1.85 | 1.72 | 1.66 | 1.43 |
| Other Produsts | 1.57 | 1.55 | 1.57 | 1.45 |
| **Total** | 15.68 | 15.45 | 15.36 | 14.49 |

As seen in Table 8, there is actually a downward trend in the demand for finished products in both the USA and OECD Europe in the period 2006-2009. One reason is the financial crisis that injured the industry. Another reason is the increasing use of renewable energy sources due to the environmental politics on both continents.

But there are differences in both markets. The USA is the biggest consumer of gasoline, thus it needs to import or produce this product regularly. On the other hand, Europe is a big market for gasoil. This means that the USA can ship excessive quantities of gasoil to Europe and Europe can ship its excessive quantities of gasoline to the USA. It is all due to the nature of the distillation process and the crack spreads.

The market for finished physical products is the one that almost everyone in the world has encountered. For traders it can be the starting point in the world of oil. This is possible mainly due to the smaller quantities that are moved. There are standardized contracts, whose minimal volumes are far smaller in comparison to crude.

[45] Ibid., pp. 9–10.

### Oil Companies

Oil companies are the ones that actually provide the gasoline or diesel fuel to the gas station and from there in the consumer's vehicle. The big oil companies in modern days have extended their fields of operation in the upstream (searching, extraction, and production of oil) and the downstream (refining and selling of oil) side of petroleum. A lot has been said about these major players over history. Many debates have been initiated in the past decades and a lot of ink has been used. Maybe the following table can show what the big oil companies are nowadays.

**Table 9 World top energy companies according to Platt's 2011**[46]

| Rank | Name | Country | Assets | Revenues | Profits |
|---|---|---|---|---|---|
| 1 | ExxonMobil Corp | Texas, USA | $302,510 mil | $341,578 mil | $30,460 mil |
| 2 | Chevron Corp | CA, USA | $184,769 mil | $189,607 mil | $19,024 mil |
| 3 | Gazprom Oao | Russia | $330,261 mil | $118,401 mil | $32,443 mil |
| 4 | Petrochina Co | China | $254,914 mil | $220,177 mil | $21,034 mil |
| 5 | Total SA | France | $206,640 mil | $189,153 mil | $14,234 mil |
| 6 | Royal Dutch Shell | UK | $322,560 mil | $368,056 mil | $20,127 mil |
| 7 | ConocoPhillips | Texas, USA | $156,314 mil | $175,752 mil | $11,358 mil |
| 8 | China Petroleum | China | $153,143 mil | $281,981 mil | $10,788 mil |
| 9 | OJSC Rosneft | Russia | $93,829 mil | $61,942 mil | $10,400 mil |
| 10 | Lukoil | Russia | $84,017 mil | $104,956 mil | $9,006 mil |
| 118 | British Petroleum | UK | $272,262 mil | $297,107 mil | $-3,719 mil |

Apart from the huge profits these companies have achieved, the nationality and location of their headquarters can be of interest. The top is occupied by the successor companies of Rockefeller's "Standard Oil" – ExxonMobil and Chevron. There are also companies from Russia and China, two of the BRIC countries. British Petroleum (BP) has, however, fallen in the rankings due to the "Deepwater Horizon" incident but it is trying to regain its lost reputation.

The trading companies are the ones that move the physical product from the refinery all the way to the final consumer. All of the above corporations have trading brands that deal with this problem. But there also exist many other small and big companies that operate in this field. Trading companies have been the source of market disruptions and squeezes in the past. Speculating and hedging is a main part of their business strategy.

### Financial Institutions

The financial institutions that have ventured into the oil market have two main objectives. The first is to invest their spare capital in the lucrative market. The second is to make profits from the high volatility of oil by speculating.

One of the usual financial sectors is that of the banks. Because they have spare capital in the form of deposits, they are often using it to make deals in order to achieve higher profits than the usual LIBOR rates or interest rates. Overnight deals were pretty much common for

[46] "Platts: Top250," http://platts.com/Top250Home, accessed February 2012.

European banks before the US mortgage market collapsed in 2008. Banks can be divided in the following groups:

- Central banks
- Commercial banks
- Merchant/investment banks
- Cooperative banks
- Mortgage banks
- Giro banks and national savings banks
- Credit unions
- Islamic banks

What they have in common is their part in the so called “debt merry-go-round.” As money is usually raised by a bank loan, lenders have to cope with interest rates. Furthermore, the banks role in the oil market can be summarized as an intermediate between the participants in the supply and demand chain of petroleum.[47]

The rest of the financial sector in the oil market can be anyone with money, who is willing to invest it. This can vary from a single individual to a large fund. Funds can be pension funds, mutual funds, equity funds, fund of funds, or hedge funds. Without a doubt, the most influential ones are the hedge funds. A hedge fund is an actively managed fund that seeks an attractive absolute return. That is a return, regardless if markets go up or down. This is what is the untypical about hedge funds, as most investors like index traders usually make a profit only when the market goes up. They are designed for high net worth individuals or investment institutions. A hedge fund company may run different small funds, each with a different strategy. Since their interest is an absolute return, they are not interested in relative returns like many other managers.

**Table 10 Largest hedge funds December 2010[48]**

| Largest hedge funds, December 2010 | $bn |
|---|---|
| Bridgewater Associates | 60 |
| JP Morgan Asset Management | 41 |
| Man Group | 40 |
| Brevan Howard Asset Management | 32 |
| Paulson & Co | 32 |
| Highbridge Capital Management | 27 |
| Soros Fund Management | 27 |
| Och-Ziff Capital Management | 26 |
| BlueCrest Capital Management | 25 |
| Cerberus Capital Management | 24 |

Hedge funds originated in 1949. Alfred Winslow Jones formed a partnership and took both short (sell) and long (buy) positions on similar companies in the same sector. This was the

[47] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), pp. 1–20.
[48] TheCityUk, *Hedge Funds*. pdf (2011), p. 5.

first example of a portfolio hedge. If their favourable firm performed well, they made money. If its shares went down, the shares sold short (in advance) made money. This is also the origin of the word "hedge".[49]

Although the data provided in Table 10 is estimated, the pure monstrosity of hedge funds and their possible investing opportunities is impressive. Because of their search for lucrative markets, they have already written pages in modern finance history.

In 2007, the leading 20 hedge fund and equity fund managers earned $657.5 million. Assuming a 60-hour week, this accounts for about $210,737 an hour.[50] To go even further, the Black Wednesday on the 16th of September 1992 has to be mentioned. Soros' Quantum Fund sold short the pound sterling to profit from a fall in the UK's currency. In the end, the UK devalued the pound, giving Soros a $1.1 billion gain. Black Wednesday cost the UK taxpayer an estimated 3.4 billion pounds.[51] George Soros commented this event later:

> *"Our total position by Black Wednesday had to be worth almost $10 billion. We planned to sell more than that. In fact, when Norman Lamont [the UK chancellor] said just before the devaluation that he would borrow nearly $15 billion to defend sterling, we were amused because that was about how much we wanted to sell."*[52]

Basically, this is why hedge funds are one of the influential players on the oil market. Their investment strategies can lead to global disruption in petroleum prices.

### 3.2.5 Platt's

Platt's can be described as the real physical world. It is an information source for finished physical oil products with reference to the location of loading. Over the years, Platt's has evolved to a global benchmark, with traders using the daily prices published by this information agency to price their commodity. Common examples are selling on Platt's + $20 or buying on Platt's + $10. All provided prices are in US dollars for one metric tonne, except for crude as it is always in $ per barrel.

Platts' assessments reflect a market on closure in each major region. They reflect tradable values, in line with the best available bids and offers standing at the close of the assessment process. Importance is given to swap trades, confirmed trades, and indications upon producing an assessment. Other factors are time spreads and trading patterns. Transactions that are done after the market closure are disregarded. Platt's purpose is to create transparency in the market. This is why it has to be completely independent.[53]

In Europe, the assessments reflect a market on close value at 16:30 London time for all products and participants. The working days are from Monday till Friday. The products offered are crude oil spreads, swaps, and futures. Also, most finished products from light till heavy distillation ends are represented. The major ones are gasoline, diesel, jet, gasoil, and fuel oil. Because there are no futures of the above products available on commodity

[49] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), pp. 236–237.
[50] Satyajit Das, *Extreme money: The masters of the universe and the cult of risk* (Harlow, England ;, New York: Pearson Financial Times/Prentice Hall, 2011), p. 365.
[51] Ibid., p. 278.
[52] Ibid., p. 278.
[53] Platts, "Derivatives Methodology guide: Platts Forward Curve-Oil," (2011): 2.

exchanges, the daily Platt's quotations allow for the managing of price risk by using swaps and other derivatives.[54]

Price reporting agencies like Platt's play an important role in the assessment of the price of international benchmarks. These prices are central to the oil pricing system and are used by oil companies and traders to price cargoes under long-term contracts or in spot market transactions. The decisions that are taken by these agencies act as "a mirror to the trade". However, the accuracy of these assessments heavily depends on a large number of factors. Therefore, the methodologies used and the information provided by them may not always be accurate.[55]

### 3.2.6 Brent

The Brent market in the North Sea is the central stage for the current oil pricing system. The prices generated in the Brent complex represent the main price benchmarks, on the basis of which 70% of the international oil trade is directly or indirectly priced.

In the early 1980s, the Brent market was only a spot market known as the Dated Brent. From then on, it has grown to a complex structure, which is made up of a large number of layers. They include a highly liquid futures and swaps market in which a variety of financial instruments are actively traded by a wide range of players. Many factors favoured the choice of Brent as a benchmark. One of them is the geographic location of the North Sea, which is close to the main refining centres in Europe and the USA.[56]

The evolution of Brent to a global benchmark has been remarkable. It is an offshore crude oil extracted off the Shetland Islands, part of the UK. Shell UK, the field operator, together with Exxon, gave the crude the name of a typical goose found in the region, namely the Brent goose. In the begging, the production was exported from the offshore terminal of Spar, and since 1979 – from the terminal of Sullom Voe. This terminal receives, apart from Brent, also Ninian, which is crude discovered and extracted by the BP/Chevron consortium. That is how the exported crude became the Brent blend, which gathered the production of around 15 fields in the North Sea. It is operated by the two consortia – Shell UK-Exxon and BP-Chevron.[57]

**Table 11 Oil production Brent and Ninian System[58]**

| | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|
| Brent System | 885 | 791 | 734 | 503 | 450 | 450 | 547 |
| Ninian System | 346 | 302 | 373 | 374 | 366 | 324 | 309 |
| Total Blend | 885 | 791 | 734 | 503 | 450 | 773 | 856 |

But as the production volumes of Brent started to decrease, other grades of crude oil had to be introduced to the blend. Their characteristics can be seen in Table 12.

[54] Ibid., pp. 2–6.
[55] Bassam Fattouh, "An Anathomy of the Crude Oil Pricing System," 2011, p. 78, http://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/03/WPM40-AnAnatomyoftheCrudeOilPricingSystem-BassamFattouh-2011.pdf, accessed February 2012.
[56] Ibid.
[57] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 89–90.
[58] Bassam Fattouh, "An Anathomy of the Crude Oil Pricing System," 2011, p. 37, http://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/03/WPM40-AnAnatomyoftheCrudeOilPricingSystem-BassamFattouh-2011.pdf, accessed February 2012.

**Table 12 API and sulphur content of BFOE crudes**[59]

| | Forties, before Buzzard | Buzzard | Brent | Oseberg | Ekofisk |
|---|---|---|---|---|---|
| API | 44.1 | 32.6 | 38.1 | 37.7 | 37.5 |
| Sulphur Content | 0.19 | 1.44 | 0.42 | 0.23 | 0.23 |

The creation of the current benchmark BFOE, which derives its name from the grades of crudes it consists, was due to the low physical production of Brent. Nevertheless, it is still commonly referred to as Brent or North Sea. Another reason was to avoid market squeezes.

In 2000, one trading company, with the help of other companies, managed to raise the price of Brent by about $2 per barrel for several days. They bought the entire physical quantities on the market. But they also bought the forward financial contract in advance. As a result, there were no quantities of Brent to satisfy their demand, so they received large compensations. Although they were successfully sued by a refiner company, who could not purchase cargoes of crude, the fragility of the marked was exposed.[60]

This squeeze was made possible mainly due to the available financial instruments. The most important are Brent Forwards, Contracts for Difference (CFDs), Exchange for Physical (EFPs), and Brent futures, options and swaps. Some of these instruments are traded on regulated exchanges like futures on ICE. Others are two-sided and are traded over-the-counter (OTC). All of these layers are essential for the risk manager and they will be discussed in detail in the following chapter of the thesis.[61]

To conclude this part on Brent, it is important to show a comparison with the other major benchmark – WTI.

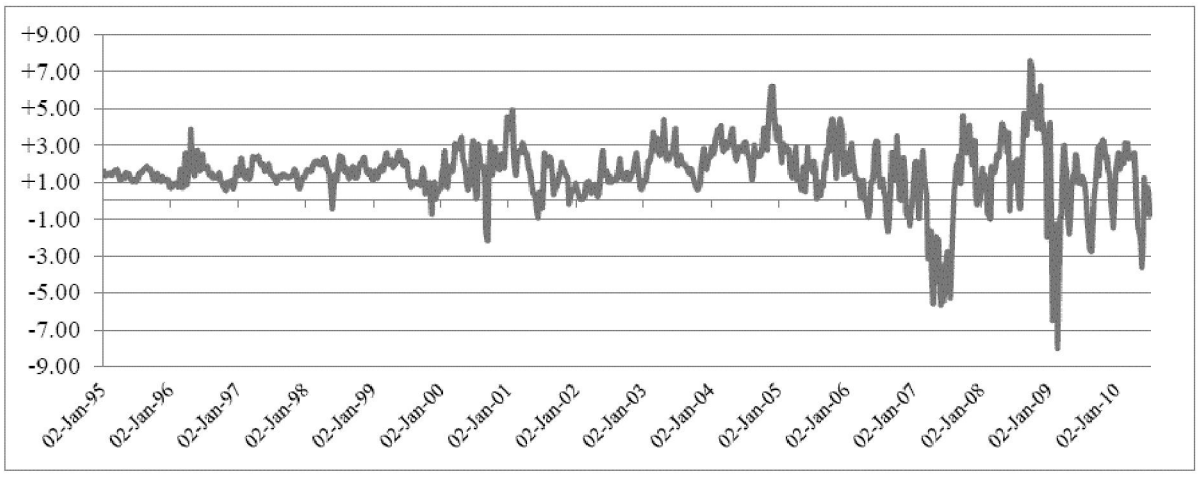



**Figure 9 WTI-Brent differential in $/barrel**[62]

What can be seen, are the fluctuations from 2007 till 2009, when Brent was at times the more expensive crude grade. But WTI is actually a crude oil of better quality and its price

[59] Ibid.
[60] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 124–125.
[61] Bassam Fattouh, "An Anathomy of the Crude Oil Pricing System," 2011, p. 39, http://www.oxfordenergy.org/wpcms/wp-content/uploads/2011/03/WPM40-AnAnatomyoftheCrudeOilPricingSystem-BassamFattouh-2011.pdf, accessed February 2012.
[62] Ibid.

should be higher than that of Brent. In late 2008 the difference between both reached $18 per barrel.[63]

This was mainly due to the fact that all the crude oils produced in the south of the USA are collected in the terminal in Cushing, Oklahoma. From there, they are sent via pipelines to the north. Because it is not possible to move these crudes in other directions like to the eastern refineries, traders and investors started to sell WTI on NYMEX and buy Brent on ICE. Some had even hired all the railroad capacity in advance and profited from this unusual price spread.[64]

### 3.2.7 Commodity Exchanges and OTC

The major commodity exchanges are the Intercontinental Exchange (ICE) in London and the New York Mercantile Exchange (NYMEX) in the USA. They serve as the trading platform for derivative instruments like futures. Their role is to provide price formation mechanisms, supervision of trading, authorization of members, settlement of transactions and publications of trade data and prices.[65] Furthermore, it is the simultaneous matching of trades and the role of the clearing house that makes exchanges so valuable.

As the basics behind all exchanges are almost the same, this thesis will concentrate on the ICE in London. London is a major trading centre and it is preferred by many investors and traders due to some of the following reasons:[66]

- **Time zone**: London can "talk" with Tokyo in the morning, with the Middle East at noon, with New York/Chicago in the early afternoon and with Los Angeles at late afternoon.
- **Tradition**: London has a historical and traditional role as a major financial centre.
- **English Language**: English is the major language in international finance. This helps London to score over Paris or Frankfurt.
- **Euromarkets**: Because of the large number of countries in Europe, London is a preferred place due to its traditions and lack of protectionism.

The ICE was established in May 2000. Its mission was to transform the OTC markets by providing an open, accessible, around-the-clock electronic energy marketplace. In June 2001, ICE expanded its business into futures trading by acquiring the International Petroleum Exchange (IPE) in London, which is now ICE Futures Europe. This is Europe's leading regulated energy futures exchange. ICE Futures are relied upon to price approximately 2/3rds of the world's physical oil. In April 2005, it became the first fully electronic energy exchange, opening these markets to traders around the globe for the first time in history. By 2006, ICE's platform was expanded to include WTI crude oil contracts.[67]

Among the commodities traded on the ICE, one of the most important are the energy ones listed there. These are Brent, WTI, Gas Oil, and Natural Gas futures and also Gas Oil crack spreads and crude differentials. Due to the large volumes of trade, there are minimal

[63] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), p. 24.
[64] Ibid., pp. 26–27.
[65] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), p. 186.
[66] Ibid., pp. 338–339.
[67] "ICE: A History of Transparent Markets," https://www.theice.com/history.jhtml, accessed February 2012.

quantities and ticks (fluctuations) for any product. The main specifications for the main products can be seen in Table 13. Additional information can be found on ICE's official internet address under www.theice.com.

**Table 13 Contract specifications on ICE for Gas Oil, Brent and WTI**

| | lot size | Quotation | min. price flux | Listing |
|---|---|---|---|---|
| Gas Oil | 100 mt | USD/mt | 25 cents/tonne | monthly, up to January 2015 |
| Brent | 1,000 bbl | USD/bbl | 1 cent/bbl | 72 consecutive months |
| WTI | 1,000 bbl | USD/bbl | 1 cent/bbl | 72 consecutive months |

The above contracts on the ICE have standard volumes and price fluctuations. This means that the desired contract quantity must be equal to or a multiple of the lot size. If we take Gas Oil for example, the minimum quantity is 100 metric tonnes. This means, that if someone needs 50 mt or 250 mt for, he has to find another way.

This is a reason why over-the-counter (OTC) deals have been introduced. These are bilateral contracts between supplier and consumer. Typical counterparties can be traders, companies, and banks. The main advantage of OTC dealing is the flexibility, as the product can be adapted to the precise user's needs. But there are also some disadvantages.

The main one concerns the liquidity of OTCs as compared to exchanges. Because the product can vary, it can become hard to find the counterparty to trade with. Exchanges, on the other hand, are characterized with high liquidity, as there are billions of US dollars that change hands daily only on the ICE. The other major disadvantage is the considerable counterparty risk. This is why exchanges have clearing houses, which serve as mediators. The role of the clearing house is to match, settle, and verify trades. Thus all counterparty risks can be avoided.[68] In the last years, however, the ICE has introduced OTC clearing systems for some energy commodities.

**Table 14 ICE Futures Europe Volumes for 2011[69]**

| | Futures | | | Options | | | Monthly Totals | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Brent | Gas Oil | WTI | Brent | WTI | Gas Oil | Futures | Options | Overall |
| **January** | 10,681,994 | 5,282,513 | 6,432,931 | 105,444 | 100,955 | 24,020 | 23,220,742 | 310,123 | 23,530,865 |
| **February** | 10,956,940 | 5,746,450 | 5,609,916 | 140,795 | 59,130 | 40,502 | 23,279,088 | 311,537 | 23,590,625 |
| **March** | 11,120,576 | 6,638,953 | 4,644,938 | 147,101 | 55,499 | 37,981 | 23,944,553 | 335,964 | 24,280,517 |
| **April** | 8,457,359 | 4,440,532 | 3,327,772 | 111,300 | 49,461 | 24,471 | 17,098,636 | 235,722 | 17,334,358 |
| **May** | 11,122,002 | 4,874,862 | 4,415,079 | 149,475 | 39,073 | 38,940 | 21,371,145 | 257,218 | 21,628,363 |
| **June** | 12,976,247 | 5,257,682 | 4,565,426 | 241,995 | 47,229 | 52,182 | 24,300,102 | 416,616 | 24,716,718 |
| **July** | 8,915,456 | 4,255,517 | 3,192,182 | 185,302 | 95,496 | 18,528 | 17,698,350 | 398,186 | 18,096,536 |
| **August** | 12,266,837 | 6,601,923 | 4,734,168 | 234,026 | 50,881 | 38,180 | 25,413,469 | 418,862 | 25,832,331 |
| **September** | 12,733,849 | 6,151,612 | 3,902,865 | 190,903 | 65,454 | 28,370 | 24,269,034 | 353,084 | 24,622,118 |
| **October** | 12,454,684 | 6,655,441 | 4,132,829 | 275,501 | 87,559 | 40,458 | 24,657,739 | 493,248 | 25,150,987 |
| **November** | 12,495,149 | 5,912,474 | 3,953,360 | 257,770 | 112,308 | 44,760 | 24,052,605 | 545,305 | 24,597,910 |
| **December** | 7,875,355 | 3,975,888 | 2,194,098 | 152,121 | 67,027 | 19,435 | 15,265,137 | 347,455 | 15,612,592 |
| **Total** | **132,056,448** | **65,793,847** | **51,105,564** | **2,191,733** | **830,072** | **407,827** | **264,570,600** | **4,423,320** | **268,993,920** |

[68] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), pp. 381–382.

[69] "ICE - Report Center - Data," https://www.theice.com/marketdata/reports/ReportCenter.shtml?reportId=26, accessed February 2012.

The Monthly totals include other commodity features and options. This is why the sum does not add up. But it can be clearly seen that the most traded products by far are Brent, Gas Oil, and WTI futures. Also, the immense volume of these contracts can arrange for headaches.

### 3.2.8 Contango and Backwardation

These are both terms for the market structure. According to market data and analyses, forecast prices are given for the future months. Because these prices fluctuate, two different scenarios can happen:[70]

- **Contango**, this is when the price of today is lower than that of the subsequent months. This is the classic situation where a price increase is expected.
- **Backwardation**, this is when the price of today is higher than that of the subsequent months. In this situation specialists expect a fall in prices.

The following two graphics present the classical contango and backwardation pattern.

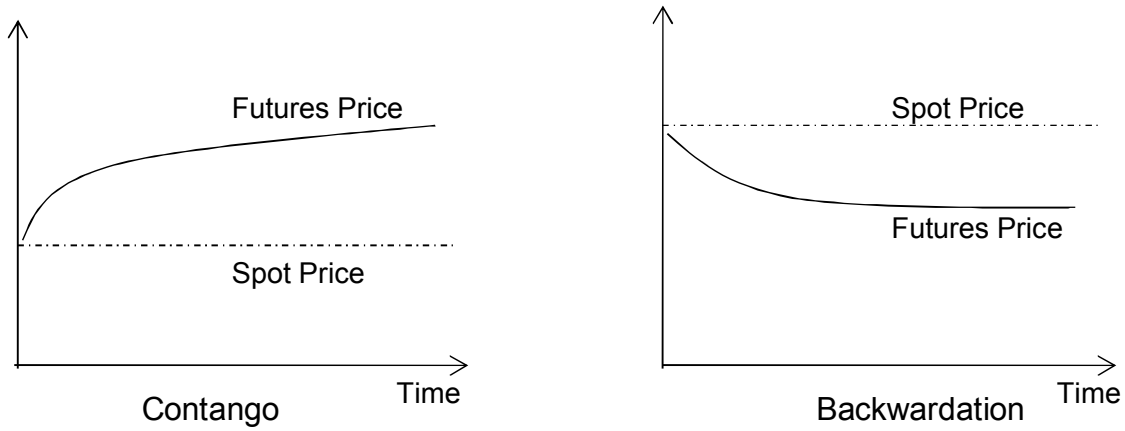



**Figure 10 Contango and Backwardation**[71]

A good example for contango is the price of Brent (Figure 1) from 2007 till mid 2008 as the prices were constantly going up. From there, they fell rapidly till the beginning of 2010. The spot price was higher than the price for the following months. This is an example for backwardation.

But as the prices were going up in the period 2007 - mid 2008, there was also plenty of room for speculations. Cargoes of crude were held on water. In this way, people could make money from the monthly future difference. If they delivered in the next month, they could increase their margin by a couple of dollars per barrel. As tankers can often carry loads of about 100,000 metric tonnes, the profit can easily exceed a million USD. This is how the so called “floating storage” came to be.[72]

[70] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), p. 117.
[71] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), pp. 198–199.
[72] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 117–119.

## 3.3 Financial Backgrounds

Because the oil market has evolved to a physical market and a financial market, it is important for traders and consumers to have a basic understanding about these two very different worlds. This part of the thesis will deal with the basic financial terms. As the traded financial (paper) volumes exceed by many times the actual physical oil trade, the understanding of time values is important.

### 3.3.1 The Time Value of Money

The concept of the time value of money allows for the comparison of cash flow values received at different times. These cash flows usually depend on the rate of interest per period, the number of periods until the cash flow is received, and the method of compounding. For example, if a dollar is received today it will be worth more than a dollar received tomorrow because this dollar could be invested and earn interest. The value of a cash flow in today's money is the present value. The value measured at some future time point is its future value.[73]

PV = present value
FV = future value
r = rate of interest earned per period
n = number of years

The process of going from present values to future values is known as compounding. It allows an investor to determine how much a current cash flow will be worth at some future point. The formula is the following:

$$\mathrm{FV_n} = \mathrm{PV}(1 + \mathrm{r})^{\mathrm{n}}$$

If an investor invests $1000 with a 10% rate of return per year, he will have $1100 at the end of one year. If the rate would be 5% for five years, the value of the invested amount would be equal to $1,276.28.

The process of going from future values to present values is known as discounting and it can be calculated with the formula:

$$\mathrm{PV} = \frac{\mathrm{FV_n}}{(1 + \mathrm{r})^{\mathrm{n}}}$$

Supposing, the same investor is expecting to receive a payment of $1000 in two years with an interest rate of 10% per year. Using the formula above, the present value of this cash flow will be $826.45.

What influences interest rates is the likelihood of getting paid. This is due to the one responsible for paying back the money in the future. The more likely the debtor is to meet his/hers obligations, the lower the interest rate. A popular benchmark for interest rates is

[73] Patrick Cusatis and Martin R. Thomas, *Hedging instruments and risk management* (New York: McGraw-Hill, 2005), pp. 9–10.

LIBOR (London Interbank Offered Rate), the rate at which major banks borrow unsecured money from one another.[74]

### 3.3.2 Basic Terms

**Risk** can be defined in many ways. It is the possibility of an uncertain change, particularly a change for the worse. From a financial perspective this means that there is a chance of suffering an economic loss or there is a chance of some return objective not being met. For example an annual return of 10%. Some risks can be determined quantitatively. This is the case in lottery winning odds or casino chances. Others can only be estimated. For example, a person's risk of being struck by lightning cannot be known with certainty. Assumptions have to be made regarding weather conditions, previous cases, geographical position, population density, and so on. In this case, past history has to be examined to make predictions about the future.[75]

**Derivatives** refer to any financial instrument that derives its value from something else, which is called the **underlying**. Anything other than a spot transaction is a derivative. The option to purchase one barrel of crude in the future for a price agreed on today is the derived product, with the barrel acting as the underlying. The derivative instruments are futures, options, forwards, and swaps. Many other derivative products originate from these four. The professional users of derivatives are hedgers, speculators, and arbitrageurs.[76]

**Arbitrage** is to make a risk-free profit by simultaneously buying one security or commodity and selling another. Arbitrage opportunities exist extreme rarely, and if they do, they last for a short period of time.[77]

**Hedging** is a technique for limiting risk. A hedger is at risk if a given potential price movement happens. Hedgers seek to create a profit from this price movement in another market so as to create a gain in particular compensation for the loss.[78] If a trader expects oil prices to rise, he can use the paper market to offset an eventual loss in the physical. Thereby, it is crucial to take the right hedging decision, in order not to fall victim of losses in both the physical and financial markets. Hedging can be used to lock a desired price, lock a certain profit margin, or to make the cash flow curve "smoother".

**Speculators**, like hedgers, can use both markets to make profit. The difference is that speculators are willingly taking risk to achieve future gains, whereby, hedgers are aiming to avoid any potential risk. Although speculators can disrupt the usual market structure by trading huge paper quantities, they play an important role in providing liquidity to the market. If there were no speculators, hedgers could find the corresponding counterparty to exchange risks with difficulty. The higher the risk, the higher the gain is for speculators.

[74] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 56.
[75] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), pp. 17–18.
[76] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), p. 381.
[77] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 2.
[78] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), pp. 401–402.

**Liquidity** defines markets, where it is easy for buyers and sellers to meet one another. This makes it easy to convert a financial instrument or commodity into cash.[79] Exchanges are very liquid, as there is always a bid and ask spread for most listed products. OTC contracts are usually fairly liquid, as it can be difficult to find the counterparty for a specified product. Because most energy products like gasoil, or gasoline or even electricity have certain seasonal patterns, the energy market can sometimes become illiquid due to traders past experiences. This is where speculators contribute to the liquidity of this market.

**Long** and **short** are terms used by traders to describe their positions. Long is used for "buy" and short – for "sell". If a trader agrees to buy oil at the market price a year from now, he is "short" oil. This trader will benefit when the price of oil falls because he can buy it more cheaply. However, if the trader agrees to buy oil at a specific price a year from now, he is "long" oil. The more expensive oil becomes, the more money he can save from buying at a fixed price. Long and short positions can be used simultaneously for the purchase and selling of a commodity. In general:[80]

- A **long position** always benefits from a rise in prices. Long positions are always indicated by a positive sign.
- A **short position** always benefits from a rise in prices. They are always indicated by a negative sign.

In the energy market all traders are referred to as long and short positions.

**Short Selling** is a way of making money out of a price fall. This is a technique often used by speculators and hedge funds.[81] Good examples for short selling are internet ticket brokers. If there is a concert in three months in a location nearby, one may chose to buy a ticket in advance. But if the official ticket office will put the tickets in sale just two months prior the concert, ticket brokers are a way of getting the desired ticket. They can have listed prices for tickets, without even owning the ticket. These ticket brokers assume that they will be able to find the ticked at a lower price than specified on their internet site. So when the customer orders a ticket online, the brokers will have to get the ticket from the official ticket office or from somewhere else at lower costs. This profit margin is their gain. In the oil business, short selling can be easily applied by speculators and financial institutions due to the high price volatility of petroleum.

**Leverage** or **gearing** is the ability to carry out a deal with only a small amount of the investor's capital. One way is to put forward a premium or a margin. Another is to borrow all or most of the money. The effect is that a given percentage change of the security or commodity produces a bigger percentage profit or loss for the investor.[82] In this way, one can bet on fluctuations of any price. For example, with $20,000 one can take positions in $1,000,000 worth of shares or an underlying. If the price goes up by 10%, a profit of $100,000 is made with just $20,000 actually invested. This is a return of 500%, if all other costs like loan interest and transaction costs are excluded. But if the price decreases, the investor will face huge losses. Leverage is all about the willingness of taking risks. With

[79] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 60.
[80] Ibid., p. 49.
[81] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), p. 240.
[82] Ibid., p. 240.

leverage, one can achieve huge profits. To quote Das (2011): “Give me enough debt and I shall make you all the money in the world.”[83]

**Volatility** is the standard deviation of continuously compounded returns. It is used by traders as a measure for risk. Volatility is the inclination of the market to see a large price movement. Market volatility goes in cycles. Sometimes the financial markets are quiet, and sometimes the prices can change rapidly. Option buyers and sellers are exposed to the market volatility cycle. Because options include a premium that has to be paid in advance, the following two scenarios can happen:[84]

- An option buyer who is long volatility benefits when large price movements become more likely.
- An option seller who is short volatility will benefit from a quiet market.

**Correlation** is a part of statistics that is particularly useful for energy traders. When two things are statically correlated, they have a direct linear relationship. For example the correlation of the prices of different petroleum products is of crucial importance to a hedger. If the hedger is long fuel oil on the physical market and is short Gas Oil futures on the paper market, the both prices need to have similar movement patterns. If the price of fuel oil goes down and the price of gasoil increases, then the hedger is exposed to price risk. The most common way to measure the relationship between two sets of data is to use the so called correlation coefficient, abbreviated *r*. It is a number between -1 and +1 and it indicates the strength of relationship between the two data series. An *r* equal to +1 means that the series behave identically. Correlation coefficients of -1 mean that prices are inversely proportional. And a correlation coefficient of zero indicates no relationship between prices.[85]

**Benchmark** is a diversified portfolio or index that forms a reference against which the performance of a portfolio, and its manager, may be measured.[86] In the oil market, benchmarks are used as price references. Platt’s is a benchmark for physical oil products. Brent is a benchmark for crude oil and for crude oil futures. There also exist local benchmarks, which are typical for a certain market. For example, Lukoil prices can be used as a local price benchmark in Bulgaria.

[83] Satyajit Das, *Extreme money: The masters of the universe and the cult of risk* (Harlow, England ;, New York: Pearson Financial Times/Prentice Hall, 2011), pp. 16–17.
[84] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 206.
[85] Ibid., pp. 196–197.
[86] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), p. 260.

# 4. Managing the Risk

> "Non-professionals are astonished as to how banal all investment strategies are when stripped of the marketing gloss that is used to sell them"[87]

Risk is uncertainty. It can be for the better or for the worse. This means that measures have to be taken in order to avoid or reduce negative future possibilities. This is the role of risk management.

Managers are frequently faced with the question whether it is right to hedge, or not. Hedging is often associated with gambling. Some think that matters should be left to chance and that hedging costs should be avoided. Also, by hedging, no profits from future price movements can be achieved. This means that a company cannot favour from rising or falling market prices.

On the other hand, some experts refer to hedging as being essential to a manager. Sudden unfavourable price movements can be avoided with a good hedging strategy. Though there are hedging costs, which are referred to as the cost-of-carry, hedging the supply and demand chain in volatile markets can be of great importance. In the energy market, which is characterized with innate volatility, hedging presents the opportunity to gain an edge over the competitors. Furthermore, as the oil market can be regarded as the fight for the small profit margin, locking this margin in advance can allow the manager to concentrate on his/hers core business. In this way he/she can gain profits from the core business, without leaving much to chance.

But when there are hedgers, there are also speculators and sometimes arbitrageurs. This allows for complex investments strategies, where derivative instruments play a central role. Although derivatives provide the opportunity to avoid or take risks, if not used wisely, they can have devastating effects.

This chapter of the diploma thesis will deal with risk management issues. It will provide the knowledge needed for understanding derivatives and the types of risk exposure. Also, it will present examples for the use of derivative instruments in the oil business and for historical events.

## 4.1 Risk Management

The approach to risk is what can have a substantial effect on a company's portfolio. As we live in an uncertain world, there cannot be risk-free investments. This is why managers have to take decisions on a regular basis in order to remain competitive on the market. The starting point is determining the degree of risk they are willing to take.

The process of approaching risk management and hedging consists of the identification, quantification/definition, and management/mitigation of risk exposures.[88] As seen earlier, some risks can be determined easily, some can only be estimated. Through the use of

[87] Satyajit Das, *Extreme money: The masters of the universe and the cult of risk* (Harlow, England ;, New York: Pearson Financial Times/Prentice Hall, 2011), p. 7.
[88] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), p. xii.

technical analysis and historical data, predictions about the future could be made. But as this is unnatural for people and can be regarded sometimes as luck, risk can never be avoided completely. This also means that there is no such thing as a perfect hedge.

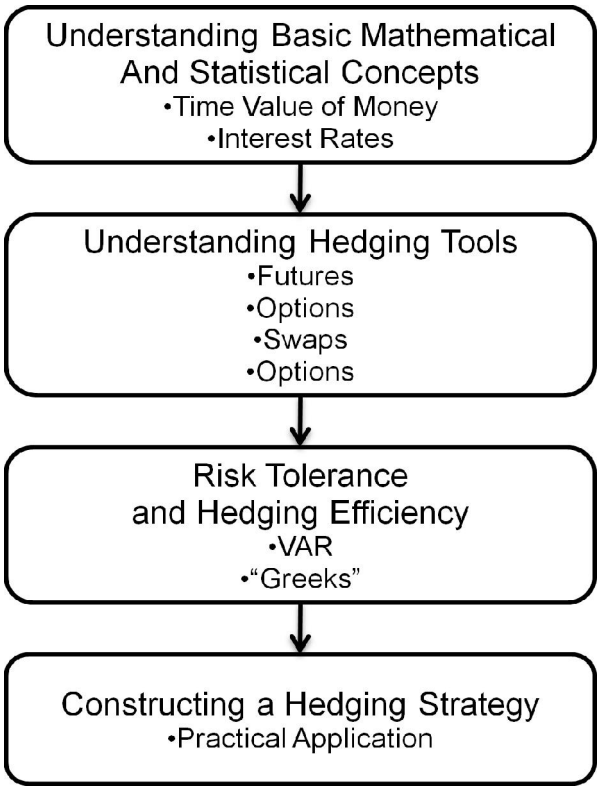



**Figure 11 Approach to hedging**[89]

The systematic approach to hedging, presented in Figure 11, can vary in its components. The manager has to decide which way to take and which methods to use. It all depends on the level of risk exposure he/she is willing to take and also on the time he/she is willing to spend in forging the strategy.

Besides derivatives, there are also different risk management tools available. Energy companies can use the following approaches to manage their risks.[90]

**Diversification**

Diversification is a risk management technique to reduce risk. It is about the dependency on resources or suppliers. By varying the number of sources, risks can be limited. Some companies can invest in many unrelated or similar businesses at different geographical locations. Also, contracts with different sources can be signed. In this way, a company's reliance on others can be reduced. However, this approach to risk management can be costly and difficult to manage. Diversification can reduce risks that are specific to each participant. But not all risks can be mitigated by this technique like, for example, a major economic recession.

[89] Patrick Cusatis and Martin R. Thomas, *Hedging instruments and risk management* (New York: McGraw-Hill, 2005), p. 6.
[90] GARP (Global Association of Risk Professionals), *Foundations of energy risk management: An overview of the energy sector and its physical and financial markets* (Hoboken, N.J: John Wiley, 2009), p. 23.

**Long-term fixed contracts**

By entering into long-term fixed contracts, companies can reduce market risk. These contracts can extend over many years. For example, tenders for the supply of oil products like gasoil. Traders can be chosen to supply government buildings or military complexes with fuel for a fixed price. The two parties share the risks of price changes and are willing to give up potential gains to compensate for potential losses. To continue this example, if the trader decides to hedge, he/she can "lock" a certain price for the raw material or product he/she must deliver. By calculating his expenses, he/she can also "lock" a profit margin. In this way, he/she can make profit without being exposed to price risk.

**Insurance contracts**

All businesses use insurance contracts to manage risk. Refineries, for example, could sign an insurance contract to reduce the damage from an eventual explosion. By doing this, the owner can acquire insurance to compensate for lost revenue as well as the cost of having to secure clients with petroleum products. Insurance shifts the risk to the insurance provider, who in exchange receives a premium to compensate for eventual losses. Insurance companies have developed specialized skills in identifying, analyzing, quantifying, and managing risks.

## 4.2 Risks

What most risks have in common is that they can cause damage to a company. Some risks can be predicted and defined. But the most damage usually comes from an uncertainty that is not expected. Furthermore, the damage that can be caused in general affects the price of a product or security. Thus, as the petroleum market is a battle for the small profit margin, the risk of an unfavourable price can be crucial. So, price risk can be defined as a combination of predicted or unpredicted evens, which influence the price of the commodity, stock, bond or anything else that someone is willing to trade. As price is actually one of the most important characteristics of a product, it can be directly or indirectly influenced by a large scope of factors.

In the energy sector some of the main predictable and quantifiable risks are the following:[91]

- Market risk
- Credit or default risk
- Operational risk
- Liquidity risk
- Political and regulatory risk

**Market risk** is the potential loss due to changes in market prices and it directly affects profitability. The investments in the oil sector can easily exceed $1 billion. Exploration expenses or the construction of a new pipeline system are among the main examples for that. This means that if the investment is not managed well, there can be considerable economic consequences. There is also a wide variety of other problems that have to be managed. One basic problem is that oil prices can vary significantly. Others can be disruptions in the supply chain due to malfunctioning pipelines or inadequate storage

[91] Ibid., pp. 14–20.

facilities. There can also be market sentiment risk. This is when excessive market optimism and pessimism pose a threat.

**Credit risk** is when the counterparty cannot make the pre-agreed payments. Because in many cases companies do not demand for a payment in advance, there can be a case of even a non-payment. This risk can also be called credit risk, counterparty credit risk, or default risk. Energy companies are exposed to credit risks in many ways as they usually have a large number of signed contracts and, thus, a large number of counterparties. This is why CDSs (Credit Default Swap) have been introduced to the market. Another risk is associated with non-performance on contracts when market prices change dramatically from the original contract price. To reduce the effects of this risk, companies can require their counterparties to post collateral in order to even to value of the trade.

**Operational risk** is the risk of loss resulting from failed or inadequate business processes or decisions. They also include external events and cover a wide range of risks, including:

- **Quality risk** is the risk the product does not meet the required specifications.
- **Storage risk** is the risk that the commodity cannot be stored appropriately, or at all.
- **Model risk** is the risk that the used models are not correctly specified.
- **Legal risk** is the potential losses from failure to comply with the low or regulations.
- **Headline risk** is the risk of negative publicity of a company

Operational risk is very important when handling hazardous commodities like crude oil and finished products, but also natural gas and electricity. Appropriate risk assessments have to be made to ensure adequate safety and to reduce the likelihood of possible hazards, such as oil spills and explosions.

**Liquidity risk** can be essential to trading companies. To initiate a trade, apart from credit concerns, liquidity is important. If the market is not liquid, the buying and selling will require significant price compromises from the parties involved, which can hurt profitability. Liquidity risk is often seen as a part of market risk.

**Political** or **regulatory risks** are those risks where political and/or regulatory actions can affect a company's normal way of doing business. Energy companies are principally sensitive to such changes, as they often have a high profile and make long-term investments. Changes in political conditions may lead to new labour and environmental regulation, or to a new taxation system. In extreme cases changes in government can even lead to nationalization.

It could be very hard to cover the extent of all the risks listed above. Although most of them are part of everyday life and traders can get used to them, these risks may require a team of professionals to deal with them regularly.

As these are the usual, predictable, risks in the energy market, there also exist many unpredictable risks, which can be hard to identify in advance. Some of them are benchmark risk, basis risk, currency risk, correlation risk, counterparty risk, commodity risk, inflation risk,

manager risk, volatility risk, derivatives risk, insurance risk, reinvestment risk, interest rate risk, and many more.[92]

To take all of them in consideration will require extensive effort, which cannot guarantee that all risk exposures have been taken care of. What a manager can do is to think "out of the box." In this way he/she can be to some point prepared for the unexpected, namely risk.

In the oil market, all of the mentioned potential risks usually lead to the increase or decrease of the oil price. This means that risk is money. It can be reduced by hedging, taken by speculators, or shifted to someone else for a premium (insurance). But all of these three actions include costs like the cost-of-carry or margins, which usually have to be invested prior a payment can be received.

It is also important to note, that rumours can complicate risk assessments. Because many financial institutions publish regularly market assessments, these can influence a manager's market perception. Thus, as many people are receiving these assessments, market over or undervaluation can happen.

## 4.3 Derivative Products

One of the fastest growing sectors of the financial markets is that of derivatives. They are named so, because they derive from another product. The four derivative products are:

- futures
- options
- forwards
- swaps

From these four, many other products can be formed. What they all have in common is that they are all concerning a specified time point in the future. Because predicting the future is not possible for the normal human being, there is plenty of room to use these products.

To summarize from the previous chapter, there is the physical oil market, the one for the delivery of a physical oil product. But there is also the paper (financial) market, the one where trades are settled by exchanges of cash flows.

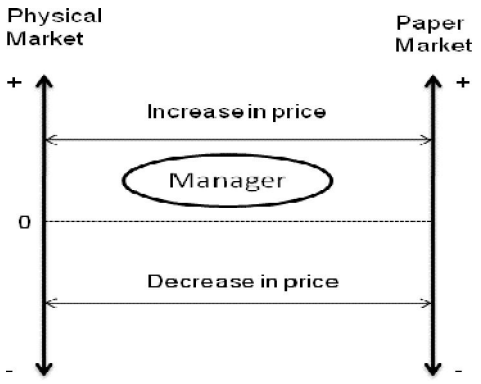



Figure 12 Market to be hedged

[92] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), pp. 18–43.

A manager has to be very careful in constructing a hedge. He or she must offset possible losses on the physical market by gaining on the paper market. If both positions lose money, the consequences can be fatal. Although much is known about the oil market, there are always potential dangers, which may strike at any time.

Derivatives, on the other hand, can be an invaluable instrument to the manager, but they can also pose substantial threat if not used correctly. Warren Buffet, one of the greatest investors of contemporary times, mentioned derivatives in his letter to shareholders in 2002:

> *"We try to be alert to any sort of megacatastrophe risk, and that posture may make us unduly apprehensive about the burgeoning quantities of long-term derivatives contracts and the massive amount of uncollateralized receivables that are growing alongside. In our view, however, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal."*[93]

The term "weapons of mass destruction" can fully illustrate why derivatives should be used with extreme caution and responsibility.

### 4.3.1 Futures

**Background**

Futures and options originated centuries ago. Some of the first users of these instruments were farmers. Because the type of their commodity was seasonal, they wanted to sell it in advance. Also, as wheat, corn, and other crops are harvested only once or twice a year, farmers wanted to be sure that they could get the price of their commodity at a reasonable level.

There are certain risks that they did not want to bear. For example, if the weather is bad, farmers could not harvest enough of the commodity or the product could be of bad quality. As they could plant a various number of commodities, the price in half an year from then could be lower than they needed to cover their expenses. If they planted wheat, the market for wheat at the time of harvest could be over-supplied because many other farmers thought that wheat would be more profitable to plant. If they all thought the same way, market gaps could appear.

This is why farmers sold product contracts before they even began to plant the next product. These contracts were the right to buy or sell the specified commodity at time or after the harvest. As they were easily transferrable, these contracts became very popular.

Another example is the 17th century Dutch tulip mania. As tulips became more and more fashionable, people bought the tulips several months in advance of the harvest. Prices soon went up and the contracts at the old prices became more and more valuable. This meant that contracts could be sold to other people without taking physical delivery, thus making profit. In some time, there were more tulips that had been already bought, than there were actually in the ground. So the government had to interfere and deal with this problem.[94]

[93] Berkshire Hathaway Inc., "BERKSHIRE HATHAWAY INC," 2003, p. 15, http://www.berkshirehathaway.com/letters/2002pdf.pdf, accessed February 2012.
[94] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), p. 481.

The difference between a physical and a paper product can be illustrated with the following example. Many can still remember the Turbo stickers, each with a picture of a car on them. If by any event, the value of a car in the real world would be exactly the same as the value of the same sticker with a picture of the same car, two similar parallel worlds would appear. If a Volkswagen Golf is worth $20,000 in the real world, the sticker of the same Golf would also be worth $20,000 in the other, paper world.

The advantage of the paper world is that the stickers can be easily exchanged and traded. If someone wants to exchange the Golf for a Ford Focus, he can exchange the two stickers in no time. In real life, this problem has to be solved through a dealer or with a physical and costly exchange of "physical" cars. With time, the stickers will become more valuable, as they can be traded more easily. This is what has happened in the world of oil. There is the physical barrel, which is filled with 42 US gallons of black liquid substance. There is also the barrel sticker, which is no more than a number on a trading platform.

**Definition**

Futures represent this number. For example, Brent futures are listed on the ICE. There is a period of 72 consecutive months and for every month there is a price for a barrel of Brent (see Table 13). All of these prices are for months in the future. If today's day is in January, the first listed month will be February.

A futures contract is a commitment to buy or sell a given quantity of an underlying product by a given date in the future at a price, which is agreed on now. Commitment means that if the price moves in the wrong direction, the contract cannot be abandoned. This is why futures can have unlimited risk, as there is practically no end to the losses someone can face.[95]

The buyer or owner of a futures contract is said to take a long position and can take delivery of the underlying asset at maturity for the price agreed on. The seller or writer of the futures contract is said to take a short position and must deliver the underlying asset if it is held to maturity. In practice, most buyers and sellers do not hold the contract till delivery. Instead, they close out the contract by selling or buying an offsetting amount of contracts before the delivery date. In this way, the futures market allows hedgers and speculators to lock prices without taking delivery of the physical product.[96] In fact, according to NYMEX, the physical deliveries of futures contracts represent only a fractional share of the trading volume. In the case of energy products this share is less than 1%.[97]

Another technique for traders to avoid physical delivery is called rolling. If the futures contract expires prior to the hedge, the trader can close out the contract and to reopen it again for a longer period of time. This is called rolling the hedge forward.[98] This is also done due to the fact that most traders have never intended on taking delivery. One of their worst nightmares would be to find a truck of a certain commodity in front of their front door.

[95] Ibid., p. 403.
[96] Patrick Cusatis and Martin R. Thomas, *Hedging instruments and risk management* (New York: McGraw-Hill, 2005), pp. 97–98.
[97] NYMEX, "A Guide to Energy Hedging," (2002): 6
[98] Patrick Cusatis and Martin R. Thomas, *Hedging instruments and risk management* (New York: McGraw-Hill, 2005), p. 238.

**Margin requirements**

Because futures are traded on an exchange, there are certain requirements. Investors are required to post collateral in a margin account. At the end of each trading day, the gains or losses from futures positions are added to or subtracted from the investor's margin account. There are two margin restrictions: initial margin requirements and maintenance margin requirements. The first one is the amount that must be deposited at the beginning. The second one is the minimum allowable margin or equity in the account that has to be maintained as prices change. If the margin falls to or under the maintenance level, the trader will receive a margin call and will have to increase the margin to the initial level. The additional margin is known as variation margin.[99]

The margin assessments are done on the daily market value of the underlying. In this way, exchanges reduce their counterparty risk exposure. For every commodity on every exchange there are different margin requirements, which are usually specified on the exchange's internet site.

**Examples**

There are two types of positions that a trader can take using futures: long and short. The long position will pay off if the price at maturity of the contract is higher than the price at the time of settlement. The short position, on the other hand, will pay off when the price at "signing" the contract is higher than the price at contract maturity. To simplify the following examples, the time value of money, transaction costs and other expenses will not be considered.

**Long hedge example**

The date is 15 January. A company is planning to sell 200 mt of gasoil in one month. The current price is $1,000/mt and the company is planning to receive $200,000. If the manager is feeling that prices may go down, he/she can buy two gasoil lots on the ICE for February. Each lot is for 100 mt.

In February, the price of gasoil has fallen to $980/mt. This means that the company will receive $196,000. This is $4,000 less than predicted, so it is a loss. On the futures market, however, the company can sell the two lots. The company will receive from the hedged market ($1,000 - $980) x 200 = $4,000. In this case, the company can offset its loss on the physical market, by gaining on the futures market.

But, if the price for gasoil has increased to $1,010/mt in February, the company will receive from the sale of the 200 mt the sum of $202,000. This is a gain of $2,000. But the manager will have to close the futures contract with the opposite position, namely sell. The company will receive ($1000 - $1010) x 200 = - $2,000. This is a loss of $2,000, which will negate the winning of $2,000 from the physical sale.

The manager has achieved a locking of a price, by using futures. This means that by hedging no profits can be made by favourable price movements. Furthermore, the company will have to pay hedging costs like transaction fees or broker fees.

[99] Ibid., pp. 103–104.

**Short hedge example**

To take the same company from the above example, but it is planning to buy 200 mt of gasoil in February and the manager is expecting prices to increase soon. The price is $1,000/mt and the manager decides to sell two gasoil lots.

In February, the price is $1,030/mt. This means that the company will pay $206,000 for 200 mt of gasoil on the physical market. On the paper market, the manager can sell the two lots and gain $6,000 from the difference between the time he bought the futures (at $1,000/mt) and the time he sells them ($1,030/mt). In this case, the company has protected itself from the increased prices of gasoil.

**Speculating examples**

As energy futures are physically settled extreme rarely, the oil market is a large room for speculators. If an investor thinks that crude oil prices will go up because of an uncertainty in a region nearby, he can bet on Brent futures. The investor is willing to bet $100,000 that prices will go up. If the current price is $100 per barrel, he can buy one Brent futures contract. This is the minimum quantity on the ICE, namely 1,000 barrel.

The uncertainty, he had considered, has caused Brent to rise to $110/bbl. The investor can sell the Brent futures contract and gain ($110 - $100) x 1,000 = $10,000. But if nothing has happened and the crude prices fall to $95/bbl, the investor will have to sell at $95/bbl, thus losing $5,000.

The investor may also borrow $900,000 to add to his $100,000 and bet the whole $1,000,000 that crude oil prices are going to rise. This is an example for leverage. If Brent futures rise from $100/bbl to $110/bbl, the investor will win $100,000. This will be a profit of 100% from a price movement of only 10%. But, as nothing always goes as planned, Brent futures may fall from $100/bbl to $80/bbl. This will result in a loss of $200,000.

**Some problems**

Firstly, there are two different markets a person needs in order to construct a hedge. If the trader makes losses on one of them, he or she needs to make a profit on the other one. This means that there is a risk of losing on both markets, if the hedge is not constructed correctly. In this case, the consequences can be fatal.

Secondly, all futures listed on exchanges are standardized. Every futures contract has name, price, and date of expiry but also - size. In the case of gasoil, the quantity is referred to as lot and it consists of 100 mt of the product. Because futures have this standard form, they can be easily traded.

But, if a trader needs to hedge a quantity of 250 mt of gasoil, he or she will have to buy/sell two or three lots. As a result the product will be over or underinsured. This can be a case of speculating, as the desired quantity cannot be hedged and the price risk exposure cannot be fully covered. In such scenarios, other derivatives can be used.

### 4.3.2 Options

Futures and options are the most used derivative instruments. The major difference between them is that options can be abandoned. Naturally, this has to be done for a certain cost. Options can be traded on exchanges or OTC. Exchange traded options are standardized. OTC options can be adjusted to the consumer's needs. Thus, many "exotic" products can be offered. Options can be looked upon as a kind of insurance.

**Definition**

An option is a contract between two sides. It gives the buyer of the contract the right, but not the obligation, to buy or sell a specified product at some future date at a fixed price. This right to buy is called a call option. The right to sell is called a put option. Options have an upfront cost, which is paid at the time the option is purchased. This cost is called the premium.[100]

In practice, options are not always executed. When purchasing the desired product on the spot market is more favourable than executing the call option, this option can be abandoned. Because the premium is paid in advance, the trader will lose money. But he will gain from the physical sale of the product. For the option buyers, options have limited downside risk. They will either lose the premium or will make a profit. For the seller, options can pose high potential losses if the price of the product varies extremely.

The buyer of the option is described as being long the option or being long volatility. The option seller, on the other hand, is described as being short the option or being short volatility. In this case, volatility means that extreme price movements are more favourable for the buyer than for the seller of an option.

A strike price is assigned to every option. This is the fixed price at which trading can be done in the future. The asset price is the price of the underlying. The underlying can be a commodity, currency, index, bond, interest rate, etc. In general, the payoff of an option is worth when:[101]

$$\text{Call Payoff} = \text{Asset Price} > \text{Strike Price}$$

$$\text{Put Payoff} = \text{Strike Price} > \text{Asset Price}$$

**Exchange traded options**

These are options that are traded on an exchange. The seller of an option is referred to as the option writer. Because they face unlimited risk, they pay a margin deposit to the clearing house. If the option writer goes default, the trade is honoured by the clearing house. On exchanges, there are four possibilities in the option game:[102]

| | *Maximum loss* | *Maximum gain* |
|---|---|---|
| Buyers of options | the premium | unlimited |
| Writers of options | unlimited | the premium |

[100] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 200.
[101] Ibid., p. 202.
[102] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), p. 384.

Furthermore, options can be exercised, or traded prior expiry. Because the options market on exchanges is very liquid, both possibilities are common. There are also standard contract sizes. There are two types of options – calls and puts.

***Call Option***

This is the right, but not the obligation, to buy a product. An example can be made by using the company from the previous section about futures. The manager needs to buy 250 mt of gasoil in one month. Because futures cannot be used to fully cover the price risk exposure, the manager can buy a call option. According to gasoil's recent price movements, a call option of $5/mt is proposed. The price of gasoil is $1,000/mt. The manager decides to take the call option and pays $5/mt x 250 mt = $1,250 for the right to buy 250 mt of gasoil in one month.

There are two scenarios. The first one is, if the gasoil price reaches, for example, $1,020/mt. The manager exercises the right to buy the product with the call option. The total purchase sum is 250 mt x ($1000 + 5$)/mt = $251,250. If the manager bought gasoil on spot market prices, he/she would have paid 250 mt x $1020/mt = $255,000. This makes a difference of $3,750.

But if the price of gasoil remains at $1000/mt or falls from this level, the manager can abandon the call option and buy gasoil on spot market prices. In this way, the premium of $1,250 is lost.

***Put Option***

This is the right, but not the obligation, to sell a product at a specified time. If the manager needs to sell 250 mt of gasoil in one month, a put option can be bought. The price of gasoil is $1,000/mt and the put option has a premium of $10/mt. The premium is paid in advance and it costs $2,500.

If, in one month, the price falls to $950/mt, the manager will use the put option and sell at $1,000/mt. But, if the gasoil price does not exceed $1,010/mt, the option can be abandoned at the cost of the premium.

**OTC Options**

These are options that are not traded on an exchange, but between two parties. The two counterparties can customize the product to meet their precise needs. So, many options variations can be formed. Except calls and puts, the most used are collar options. But there are also the so called exotics. These are option contracts with non-standardized features. Examples are plain vanilla options, trigger options, barrier options, spread options, etc.

In over-the-counter trading there is always counterparty risk. Because OTC options do not require marginal deposits, other ways to reduce this risk are imposed. This can be a letter of accreditation, advance payment, or bank guarantee. Also, options can be coupled with other derivate products and sold as a whole package.

### *Collar Option*

This is a combination of both a call option and a put option. It is achieved by simultaneously writing a call option and buying a put on the underlying. A collar limits the upside and downside price movement of an asset. It is appropriate for short-term hedging strategies.[103]

The manager from the previous examples can decide to hedge the buying/selling of the 250 mt of gasoil with the help of a collar option. If the current price is $1,000/mt, he can get a downside and upside protection by locking a price window from $980 to $1,020/mt. If the price in one month remains in this window, he will buy/sell at that price. But if the price moves outside of this window, he will pay/receive either $980 or $1,020 for one metric tonne of gasoil. Because there is more room for price risk, the premium is lower than that for a call or a put option.

### *Barrier Option*

The idea of this option is to cheapen the premium by attaching some condition. Typically, the option may be valid only if the market price reaches a certain level or barrier. If today's price for Brent is $100/bbl, a manager, who wants to sell, may want to bear a loss till the price reaches $95/bbl.[104]

### *Trigger Option*

This option can use the futures market to price a physical commodity. This is done by triggering a certain quantity, which is depending on the quotation of Brent or gasoil at the very moment. If a manager has the right to buy 100 gasoil lots for a predefined period of time, he can price the product by using the futures on a daily basis. As the option writer is in an unfavourable position, a premium has to be paid. This is why only a limited number of lots per day can be triggered.

### *Plain Vanilla Option*

This is the possibility to exchange a floating price for a fixed price over a certain time. Both parties settle their agreements in terms of cash flows on a regular basis.[105] Plain vanilla options can be used to fix an interest rate at a desired percentage.

### Intrinsic Value and Time Value

Options contracts exist for a period of time. In the examples so far only the period of one month was considered. But this period can extend over several months or years. The intrinsic value is the money that could be obtained by exercising the option immediately. The option is said to be "in the money" if it's intrinsic value is positive, and "out of the money" if it is zero or negative. The time value, or extrinsic value, is the value of the option that comes from the risk of holding it for the period of time.

$$\text{Premium} = \text{Intrinsic Value} + \text{Time Value}$$

[103] Patrick Cusatis and Martin R. Thomas, *Hedging instruments and risk management* (New York: McGraw-Hill, 2005), pp. 179–180.
[104] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), p. 398.
[105] Dave Carter, Dan Rogers, and Betty Simkins, "Fuel Hedging in the Airline Industry: The Case of Southwest Airlines," (2004): 5, accessed February 2012.

To expand the previous examples, hypothetical values will be given for a call option. The manager of the company may be faced with the decision for how many months he/she wants to hedge and at what price. The current gasoil price is $1,000 and the month is January. The different possibilities can be found in the following table.

**Table 15 Hypothetical option premium calculation**

| Strike price | Expiry | Intrinsic value | Time value | Premium |
|---|---|---|---|---|
| $1,000 | February | $0 | $5 | $5 |
| | March | $0 | $9 | $9 |
| | April | $0 | $15 | $15 |
| $1,020 | February | $3 | $8 | $11 |
| | March | $3 | $14 | $17 |
| | April | $3 | $21 | $24 |

The intrinsic value for $1,000 is zero because the spot price is the same as the exercise price of the option. But if the value increases, so will the intrinsic value. The time value increases for each of the following months after February because the uncertainty grows bigger.

### 4.3.3 Forwards

**Definition**

Forwards can be considered to be the same as futures. The major difference is that the trader is actually having the intention of taking physical delivery. Forwards are an agreement to buy or sell something at a prearranged price in the future. Unlike options, they cannot be abandoned. Also, forwards are only OTC contracts. Both counterparties have committed themselves to a transaction at a future date. The characteristics of the forward contract are:[106]

The buyer of a forward will:

- Pay no money when entering the trade.
- Agree to purchase the underlying at the strike price on the expiration date.
- Benefit if the price of the asset rises. The buyer of a forward has a long position in the asset since he/she benefits by buying at a price lower than the current market price.

The seller of a forward will:

- Pay no money when entering the trade.
- Agree to sell the underlying at the strike price on the expiration date.
- Benefit if the price of the asset falls. The seller of a forward has a short position as he/she benefits by selling at a price higher than the current market price.

[106] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 210.

As this is an OTC trade, there is substantial risk for both parties. Especially, when the oil market is concerned, price risk can cause severe damage to both buyer and seller. Also, sometimes it can be hard to find the matching counterparty as the market can be illiquid.

In the oil sector forwards can be used to manage the price risk of cargoes. These can be small ships (barges) or large oil tankers. Because there can be weeks from the time of loading the cargo to the time of delivering the load, price fluctuation are very common. Also, as this is the physical oil market, the benchmark that is used is Platt's or another price reporting agency.

**Example**

A trader wants to purchase 2 kt (2,000 metric tonnes) of gasoil to resell it on the local market. The trader finds a suitable counterparty and wants to sign a forward contract. If the current price of gasoil is $1,000/mt according to Platt's, the trader can be offered a price Platt's + $20 or higher. This is mainly because of the following reasons:

- The other party of the contract has placed a profit margin.
- The relatively small quantity.
- The uncertainty about the gasoil price at time of delivery.
- The type of delivery.

Delivery means that the trader can send his own vessel, rent a vessel or receive the quantity directly on a port terminal in his area. These three scenarios all reflect on the final price.

Assuming, the trader agrees to receive the 2 kt of gasoil in two weeks for a price CIF a location of his choice. CIF is an acronym for Cost Insurance and Freight. Because most of the risks and transportation costs are covered by the counterparty, the product's price will increase to Platt's + $35. This means that the trader will have to pay the selling party a total of ($1,000 + $35) x 2,000 = $2,070,000 at or shortly after delivery. During these two weeks, the trader can search for consumers to resell the just-bought gasoil. In this way, the trader can lock his own profit margin.

If the gasoil price has increased to $1,020/mt at the time of delivery, the trader would benefit from the forward contract. But if it has fallen to $970/mt, the trader will have difficulties in reselling the gasoil quantities as market competitors may offer a better price.

Some traders, however, can construct complicated hedging strategies by also using futures or options. The selling company in the above example can sell the gasoil cargo physical and buy gasoil futures on an exchange to hedge itself. In total, there is no limit to the number of different derivative instruments a manager can use for a single product. But as the hedge gets more elaborate, the cost of carrying it gets higher. Also, misjudgements will not be left unpunished.

### 4.3.4 Swaps

In all the examples so far, the product that had to be hedged had a corresponding match on an exchange. Crude oil can be hedged with Brent futures and gasoil can be hedged using gasoil futures. But, if we take diesel fuel for example, there are no diesel futures that are traded on an exchange. This means that other ways have to be found, to solve this problem. This is where swaps can become useful. To swap means literally to change one thing for

another. This can be a commodity like oil or it can be a cash flow. Also, depending on the swap contract, the counterparties have to exchange cash flows on a regular basis.[107]

**Background**

Using swaps to hedge their fuel price exposure was done by major airlines in the USA a decade ago. What all airplanes have in common is that they need jet fuel to fly. Because airplanes need to refuel several times a day, fuel costs account to an important part of the total airlines' expenses. Fuel price fluctuations can hardly be estimated and they can pretty much imbalance the expected cash flows.

Also, as most airlines sell their tickets in advance, high price volatility can force them sometimes to sell at a loss. Of course they can demand an extra ticket charge due to high fuel costs, but most travellers will not be happy about the fact to pay extra after they have already bought a ticket at a specified price. This is why airlines can hedge their fuel costs. But as there are no jet futures available on exchanges, other methods have to be used.

**Example**

A good example is the case of Southwest Airlines in the USA. Faced with the problem of hedging, the director of corporate finance at that time Scott Topping identified the following 5 alternatives:[108]

1. Do nothing.
2. Hedge using a plain vanilla jet fuel or heating oil swap.
3. Hedging using options.
4. Hedge using a zero-cost collar strategy.
5. Hedge using a crude oil or heating oil futures contract.

For alternative 2, there were two different possibilities. The infamous Enron offered Scott Topping an OTC jet fuel swap with a 1-year maturity. "Southwest" would receive a fixed rate of 76 cents/gallon. The floating rate was based on the monthly average price of Gulf Coast jet fuel (physical benchmark). The size of the swap contract was one million gallons. During the life of the swap contract, the airline buys jet fuel in the cash market as usual. The swap compensates the difference when prices rise and removes the difference when prices fall. The result for the airline is a fixed price for the period covered. The fixed rate payment is set based on market conditions when the swap contract in initiated.[109]

The second possibility was a NYMEX New York Heating Oil Calendar Swap for the duration of one year. The contract size was and still is 42,000 gallons. The contract guaranteed a fixed rate for "Southwest" of 73 cents/gallon heating oil. The floating rate was based on the arithmetic average of the heating oil futures (gasoil futures on ICE) for each month. What can be the problem in this case is that heating oil and jet fuel do not always follow the same price movement pattern. Although both are produced by the distillation of crude oil, seasonal supply and demand trends can influence the price gap between these two products.

Also, it is important to comment the first alternative – do nothing. To quote Scott Topping:

[107] Ibid., p. 54.
[108] Dave Carter, Dan Rogers, and Betty Simkins, "Fuel Hedging in the Airline Industry: The Case of Southwest Airlines," (2004): 9–10, accessed February 2012.
[109] Ibid., p. 24.

> *"If we don't hedge jet fuel price risk, we are speculating. It is our fiduciary duty to try and hedge this risk."*[110]

By doing nothing, a company with potential risk exposure could easily be harmed. There are managers that think of hedging as an invaluable tool. But there are also managers that prefer to leave things go their natural way. In doing so, they are leaving their company unprotected. There have been many debates whether it is right to hedge or not. It all depends on the decision of a company's management. But by doing nothing, sometimes this decision can coincide with speculating.

### 4.3.5 Variations

The derivative products that are going to be discussed in this part of the thesis are variations of futures and options, which have evolved to a certain degree to meet market demand. Therefore, all of the products are OTC traded.

**Swaption**

A swaption is the right to enter a trade in the future. The terms of the swap are established when the swaption is executed. The right to pay fixed and receive the floating rate is a call swaption. The right to pay the floating rate and receive fixed is a put option. Due to their complicated use, these derivative products are relatively expensive and require substantial financial knowledge.[111]

**Brent Frontline Swaps**

They are calendar month derivatives that are settled using the ICE Brent futures contract. These swaps are financially settled using the closing price on each day of the month, for any futures contract that is most prompt on each day. Daily Brent frontline swaps are calculated using mean adjusted values for the number of trading days that each futures contract spends as the front month.[112]

**Dated-to-Frontline (DFL)**

These swaps are traded as the difference between Platts Dated Brent assessment and the ICE front line (first month) futures contract. DFL implies the differential between the daily Platts Dated Brent assessment for dated or physical cargoes, and the ICE settlement for the front month.[113]

**Contract for Differences (CFD)**

CFDs are a type of swap that trades the difference between two commodities. It can be used to manage the risk arising from differential price movements between the two commodities. This derivative variation is a swap between the uncertain (floating) and a fixed differential price. They can be used to price physical oil products like crudes. CFDs are priced using averages of a particular week's worth of daily price assessments for the next weeks.[114]

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[110] Ibid., p. 1.
[111] Patrick Cusatis and Martin R. Thomas, *Hedging instruments and risk management* (New York: McGraw-Hill, 2005), pp. 200–201.
[112] Platts, "Derivatives Methodology guide: Platts Forward Curve-Oil," (2011): 3.
[113] Ibid., p. 3.
[114] Ibid., p. 3.

**Spreads**

There can be time spreads, quality spreads, WTI/Brent spreads, crack spreads, etc. All of them aim to price a certain difference.

**Credit Default Swaps (CDS)**

With CDFs the risk of the counterparty or bond going default can the shifted to someone else. This is done by paying a premium in advance. The value of the premium depends on the likelihood of the company or bond going default. It is done by analysing historical data and market forecasts.[115]

**Exchange for Physical (EFP)**

The buyer of a cash commodity transfers to the seller an equivalent amount of long futures contracts or receives a corresponding amount of short futures at an agreed price. This allows the hedgers of both parties to be closed out. Also termed exchange for cash and exchange against actual.[116]

These represent just a small number of the derivatives that can be used to create a hedge in the oil market. But the sheer complexity and their various fields of use can make even experienced traders easily lose sight in the derivatives jungle. There have been enough occasions in the recent past when the once defined as “weapons of mass destruction” have caused great losses. Some of the headline derivative losses are:[117]

- 1994: Metallgesellschaft, one of Germany’s largest industrial conglomerates, lost $1.5 billion on oil futures transactions.
- 2001: Enron, the seventh largest company in the USA and the world’s largest energy trader, made massive use of energy and credit derivatives. It became the largest bankruptcy in American history after systematically attempting to hide major losses.
- 2004: China Aviation lost $550 million in speculative derivatives trading in Singapore.
- 2006: Amaranth Advisors, a US hedge fund, lost $6 billion from trading in natural gas futures.
- 2008: Societe Generale lost €4.9 billion in unauthorized futures trading. A relatively junior 31-year-old trader, Jerome Kerviel, was making plain vanilla hedges on European stock market indices. He became to be the main culprit and architect of the biggest banking fraud to date.

The more elaborate investment strategies become by concerning the future in detail, the more room is there for error. To go back to the non-zero sum game, which former US president Bill Clinton mentioned once. Because there can be win-win scenarios, there will surely be lose-lose scenarios. This calls for new regulation methods, which have to be imposed by governments. But to manage risk correctly, the hedging efficiency has to be measured.

[115] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), pp. 430–431.
[116] “Exchange for Physical - Financial Glossary,” 2011, http://glossary.reuters.com/index.php/Exchange_for_Physical, accessed February 2012.
[117] Stephen Valdez and Philip Molyneux, *An introduction to global financial markets,* 6th ed. (Houndmills, Basingstoke, Hampshire ;, New York: Palgrave Macmillan, 2010), pp. 436–437.

## 4.4 Methods

There are several methods to measure the hedging exposure. They all deal with complex mathematics, which can at some point become too abstract for the ordinary person to comprehend. This is why only the Value at Risk method (VAR) and the “Greeks” will be discussed.

### 4.4.1 Value at Risk

**Definition**

Value at risk (VAR) is one of the most common measures of financial risk. It describes the size of an investment. VAR is primarily based on the day-to-day pricing of the product with the actual spot prices and on the analysis of earnings volatility. Because it is a rather simple tool, it can be used in combination with other methods. The purpose of VAR is to give a simple description of risk. So this method is not suited for describing the possibility of a loss. The four parts to a VAR description are:[118]

- The **frequency** at which some event will occur. If a month has 20 days and an event will occur only once a month, the chance is 1-20 or 5%.
- A description of the **time horizon** of the expected move. This could be a week, month, or year.
- A description of the **sidedness** of the move. If only losses are concerned, it is one-sided. If both losses and profits are expected, it is two-sided.
- A description of the **magnitude** of the move. This is the sum of money that is expected to be lost or won.

A VAR report might be: “Once a week the ship cargoes may be delayed in port, resulting in a loss of $2,000 per day.” Because they are so simple, VAR reports do not give information about what will happen if the price of the cargo increases by 20%. Also, no information is given about how bad things could really become.

**Calculating**

VAR summarizes the risk of a portfolio by predicting the size of expected cash flows that will occur with a specific frequency. It will use a single number to describe either a distribution or a group of distributions added together. In mathematical terms, the formula for calculating VAR can be expressed as:[119]

$$F(-\Delta V_{ë}) \equiv \int_{-\infty}^{-\Delta V_{ë}} d\Delta V p(\Delta V) = ë$$

Where $\Delta V_{ë}$ is VAR, $p(\Delta V)$ is the probability distribution function, $ë$ is the percentage change (profit or loss).

Because the calculation of VAR on a regular basis will require the support of computer software, hypothetical values will be used to describe the calculating process. As there are

[118] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), pp. 345–347.
[119] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), pp. 164–165.

approximately 20 trading days in a month, the frequency of a daily event is 5%. As a result, a 95 percent level can be chosen to describe the entire distribution. The methodology for calculating VAR can vary between companies. Some managers prefer to examine only loses (one-sided), while others prefer to examine the volatility of both profits and losses. A possible two-sided distribution can be seen in figure 13.

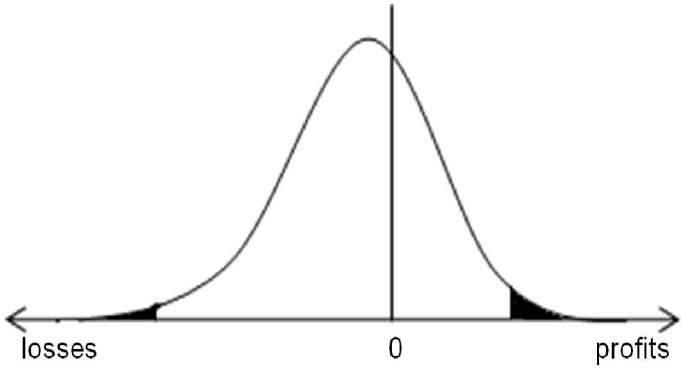


Figure 13 Two-sided VAR

The vertical axis is the probability distribution function. In this case, both profits and losses can be expected and considered. The hypothetical VAR value of 95% is marked on both sides of the distribution.

### 4.4.2 The Greeks

The Greeks are linear sensitivities that measure an asset value's response to small changes in continuous factors. The use of the term "the Greeks" is due to the fact that most of the sensitivities are denoted with Greek letters. A notable exception is sensitivity to volatility, known as the Vega. The most common "Greeks" will be described in this section.[120]

**Delta** is the most wide spread Greek. It is used to analyse the price risk sensitivity of an underlying. Delta can also be used to relate the change in value of an oil product to a chosen benchmark. In mathematical terms, delta is expressed as:[121]

$$\ddot{a}_i = \frac{\partial V}{\partial p_i}$$

In this case, $p_i$ could be the price of a stock, commodity, or a benchmark. V is the value of an asset over time. This is the absolute delta. It can be viewed as a conversion factor to translate price changes of an underlying instrument to the corresponding dollar changes in the asset's value.

**Gamma** indicates how quickly the Delta is changes. It indicates what will happen to an asset when the market becomes extremely volatile and the underlying changes substantially in price. Gamma indicates the exposure of a portfolio to changes in price. This is whether the

[120] Ibid., p. 110.
[121] Ibid., pp. 110–111.

portfolio will get more or less risky.[122] Gammas define second-order sensitivity and are denoted in capital letters.[123]

$$\tilde{A}_i = \frac{\partial \ddot{a}_i}{\partial p_i}$$

**Vega** represents the sensitivity to a change in some type of volatility. They are very important if a portfolio contains a lot of options. Because option pricing is usually based on the concept that prices diffuse outward from a starting point, small changes in this dispersion pattern will have a big effect on the value of an option.[124]

$$\mathcal{V}_i = \frac{\partial V}{\partial \ddot{a}_i}$$

**Theta** is primarily important for option trades. The time value of an option depends on its profitability. As certain assets may become less valuable with time, their value is depending on the remaining time of an option.[125] Theta is also referred to as the passage of time and it quantifies the asset value loss resulting from this time decay.[126]

$$\grave{e} = \frac{\partial V}{\partial t}$$

**Rho** measures the sensitivity of the value of an asset to interest rates. This is primarily important to financial instruments that are very sensitive to interest rates, like bonds. In the energy sector, rho can be used to measure the exposure of an investment. This means that it is necessary to compare the relative return of an investment, compared to other possible scenarios.[127]

$$\varrho = \frac{\partial V}{\partial r_f}$$

In this formula, $r_f$ can be the single contract's risk-free rate for a vanilla option.

To sum it all up, there are many methods and mathematical models that can be applied to measure the risk exposure of an underlying to a certain event in the future. Each company can decide for itself how to deal with uncertainty. Managers can choose whether they need to hedge or not. It all depends on the market and the level of competition.

[122] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), pp. 354–355.
[123] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), p. 123.
[124] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 355.
[125] Ibid., p. 356.
[126] Oleg V. Bychuk and Brian J. Haughey, *Hedging market exposures: Identifying and managing market risks* (Hoboken, N.J: Wiley, 2011), p. 118.
[127] Davis Edwards, *Energy trading and investing: Trading, risk management and structuring deals in the energy market* (New York [u.a.]: McGraw-Hill, 2009), p. 356.

# 5. The Bulgarian Local Market and Lukoil

Markets can be separated into international and local. The difference between the two is the level of complexity and most of all the level of competition. International and global markets have a complex network that is divided in many financial and physical layers, which vary according to the separate country. What this means is that there are many different types of traders and investors, who all have diverse market views. Thus, they can take various positions in the future, making the market liquid. The local market, on the other hand, is a structural element of the international market. It is characterized by peculiarities that can be native only to a specific local market. In some occasions, local markets can be relatively illiquid.

In the world of oil, with its innate volatility, it is practically impossible for anyone to make a risk-free profit. As long as there are players who are willing to take big risks, there will be market fluctuations. And when there are price fluctuations, measures need to be taken by the management of a company. Risk is, and will continue to be, a crucial part of trading and investing.

There are risk mitigation techniques that are successfully used by companies like insurance contracts, diversification, long-term contracts, and derivative products. This chapter of the diploma thesis will focus on the managing of price risk on the Bulgarian local market. This will be done by using derivative instruments. As seen in the previous chapter of the thesis, price risk is the unification of many other predictable and unpredictable risks and it is constantly being created. By using derivatives, price risk can be reshaped, accepted or transferred.

The Bulgarian local oil market is closely associated with Lukoil. The Russian energy giant is on rank 10 on Platt's top 250 energy companies for 2011. It owns the only petroleum refinery in Bulgaria, which is also the biggest refinery on the Balkan peninsular. This fact leads to the conclusion that the prices listed by Lukoil can be used as reference to measure the prices of all the physical oil products that are traded inside the country. This chapter of the thesis will be mainly based on the author's personal experience and views on the local oil market and on the estimations and views of local experts, who wish their names to remain unveiled.

## 5.1 Environment

The economic environment in Bulgaria has seen a considerable change in the last couple of years. This is mainly due to the accession of the country to the EU on the 1$^{st}$ of January 2007 and also due to the global financial crisis from 2008.

As an EU member, the doors of Bulgaria were opened to the large European market. Commodities could be moved more easily with the fall of certain limitation. Also the service sector could benefit from the large multinational European market. But there are some disadvantages as well. As Bulgaria became a part of the European market, the level of competition increased. With more and more international companies coming to the local market, the Bulgarian companies faced certain challenges. Most of all were the ways of doing business influenced. With complicated business plans and financial stability, most of the foreign companies are better organized and more precise and dedicated to their goals. To survive the increased level of competition, Bulgarian companies need to reconsider their risk tolerance and to improve their competing power.

By becoming an EU member, the Bulgarian government had to adapt its legislative system to the prescribed by the EU ways. For the energy sector this means that there are more and stricter regulations. For example the use of bio components in fuels and the lower levels of fuel emissions are the result of new laws. Companies, on the other hand, could benefit from the various EU funding programs.

The financial crisis was felt all over the world. Because companies and individuals could receive loans with difficulty, investments were drastically reduced. This injured the economy of many countries, including Bulgaria. The process of recovering has already begun. But when and to what extent the economy will be recovered remains rather uncertain. According to recent news headlines, Bulgaria is experiencing a slow economic growth in the beginning of 2012. The country has a favourable business climate, which is also due to the taxation policy of the government. The tax incentives include:[128]

- A flat tax of 10% for corporate profits and personal tax income.
- 2-year VAT exemption for imports of equipment for approved investment projects over 5 million euro, creating 50 jobs.
- Tax depreciation for two years of computers and new manufacturing equipment.
- 5% withholding tax on dividends and liquidation quotas (0% for EU tax residents).

But what these two events also mean for the Bulgarian local oil trader is the level of market liquidity. If people have money, it will be easier to make deals as counterparty or credit risk will not pose considerable threats. But if it is the other way around and the market is rather illiquid, trading can become rather risky. One of the considerable problems of the market is the low purchasing power of the normal Bulgarian customer.

If a standard diesel fuel truck cargo is taken for example. Supposed the truck has a capacity of 25,000 litres and the diesel price with all taxes is $1,500 for 1,000 litres. This makes a total of $37,500, which have to be collected by the oil trader in advance, at the time of delivery, or in some time after delivery. But this is not a small sum of money, especially for the Bulgarian market. If a trader ships several cargoes a day, this sum will be multiplied by the number of cargoes. It is a common practice to shift the cash flows of a fuel trade for a week or even a month. Also delayed and no payments at all can always be expected. This leaves plenty of room for risk.

In order to remain competitive and to offer a good price, the managers in the oil sector need to take measurements against risk. This can be done with the use of derivatives to hedge the supply and demand of oil products. But, as the profit margin is usually small, hedging costs can reduce the profit or even force a trader to sell at a loss. This is why hedging the demand part of the fuel trade may not be the wisest decision. There are other types of insurance like bank guarantees, letters of credit, and bank factoring, which transfer part or all of the costs to the counterparty.

Hedging the supply part of the oil business is what is of most importance to the local Bulgarian trader. By locking a price or a profit margin, the reselling of oil products or the processing of semi-finished oil products can become a vital part of a trader's successful strategy. The only way to remain competitive and independent is to import the needed

[128] "Bulgaria - Why invest in Bulgaria? - political and economic environment., tax environment and labour and operational costs," http://www.investnet.bg/bulgarian-economy/InvestmentIncentives/why-invest-in-bulgaria.aspx, accessed February 2012.

resources. This is the point where hedging strategies can be applied the best. There are certain specifics about the Bulgarian local market in terms of logistics. These will be discussed in the following parts of this chapter.

One of the important factors for the common oil trader is the level of competition. There are two companies that are the leading ones on the local market. One is “Lukoil Neftochim”, the producing company and the owner of the only refinery in Bulgaria. The other is “Lukoil Bulgaria”, the trading company. These two companies have functional logistical networks and local partners. Also, there are major international energy companies like OMW, Shell, Rompetrol, and Eko that have entered the local market with their chains of gas stations.

Because there is only one domestic source for refined products in Bulgaria, many will turn to it and use it to supply their needs. These needs can be for the direct realization of automotive fuels at a gas station. Or they can be for heating and aviation purposes. Thus, the local market can be separated into:

- market for diesel fuel and gasoline
- market for jet fuel
- market for middle and heavy distillates like gasoil/diesel and fuel oil

These markets can also be further divided into wholesale and retail markets. Whereby, the difference is in the size of the sold quantities.

Bio fuels could also be counted to the oil market. But as they are relatively new to the market and there are only a few producing companies, there is insufficient information available at the time of writing. Thus, bio fuels will not be discussed in this thesis. But it is important to note that from 2012 the minimum bio diesel quantity in diesel has been increased from 4% to 5% due to the new environmental regulations. The new diesel fuel is known as B5 on the local market. Furthermore, Ethanol is not used for blending with gasoline.

## 5.2 Lukoil and the local market

Lukoil is one of the world’s leading vertically integrated oil and gas companies. Main activities of the company are exploration and production of oil and gas, production of petroleum products and petrochemicals, and marketing of these products. Most of the company’s exploration and production activity is located in Russia, and its main resource base is Western Siberia. Nowadays, Lukoil is characterized in terms of its oil operations as:[129]

- **1.0%** of world oil reserves;
- **2.2%** of world oil production;
- **1.6%** of world refining capacities;
- **1.8%** of world oil refinery throughputs;
- **The largest** privately owned oil and gas company in the world by proved oil reserves;
- **3rd largest** privately owned oil and gas company in the world by **both** proved hydrocarbon reserves and by oil production.

Lukoil bought the refinery in Burgas, Bulgaria, in 1999, which was renamed later to Lukoil Neftochim Burgas. It refines Russian export blends and produces fuels and petrochemicals.

[129] Lukoil, “Lukoil Fact Book 2011,” 2011, p. 2, http://lukoil.com/materials/doc/DataBook/DBP/2011/FB/fb2011eng.pdf, accessed February 2012.

Crude oil is supplied to the refinery by pipeline from the port of Rosenets. The finished products are shipped by rail, road and sea transport, and also through petroleum product pipeline to central regions of the country. The capacity is 9.8 million tonnes per year and the main conversion processes that are used are catalytic cracking (34,800 barrels per day) and visbreaking (26,000 barrels per day). The throughput of the refinery decreased from 6.28 million tonnes in 2009 to 5.95 million tonnes in 2010. Since 2009 all fuels that are going to be sold in EU countries are produced in compliance with Euro 5 standards. By 2015, the refinery is planning to construct a complex for refining heavy residual stock.[130]

Lukoil Bulgaria EOOD, which together with Lukoil Neftochim Burgas will be referred from now on as only Lukoil, is a leader in the sales and distribution of high-quality fuels, polymers and petrochemicals, which are produced at the Burgas refinery. The facts about the Lukoil Group in Bulgaria are:[131]

- Produces up to 9% of the country's GDP
- Contributes up to 25% to the overall tax revenues
- Annual turnover exceeding $3 billion with annual sales of about 2.5 million tonnes of petroleum products
- Has a chain of over 200 gas stations (own and franchised) with about 26% market share of retail sales in Bulgaria
- Exports a large part of the processed petroleum products. The company has stable market positions in the countries of former Yugoslavia, Greece and Turkey.

As mentioned earlier, Lukoil is the biggest player on the Bulgarian market. It owns the only refinery in the country and many of the other international and local energy companies buy products from the refinery in Burgas. Of course, the purchasing process is based on the best available price. This is why sometimes importing can be more profitable than buying on the local market. The rule is simple and it concerns all petroleum products.

$$\text{Price} = f(\text{Supply} - \text{Demand})$$

It is important to note that the major companies on the Bulgarian local market receive discounts from the prices listed by Lukoil. Lukoil also has official distributors that resell large volumes on the market. This leads to a rather unclear situation regarding the wholesale and retail markets. First of all, actual information about market shares and volumes is most of the times unavailable. If it is, this information can cost a considerable sum of money. Secondly, the oil companies are not obliged to provide official statements about sold volumes and number and size of deals for statistical needs. Only the financial parameters like cash flows must be provided to the corresponding authorities.

As a result, the parameters of the wholesale market can be considered as uncertain. Some assume that Lukoil has a market share of 50% to 75% on the wholesale market.[132] According to some market experts, market information besides official NSI (National Statistical Institute) and other government institutions' may not be considered as completely reliable.

[130] Ibid.
[131] "Lukoil Bulgaria," http://www.lukoil.bg/Main.do?menuItemKey=1744-18, accessed February 2012.
[132] Tania Kirkova and Sv. Bancheva, "» Защо дизелът е по-скъп от бензина? Какво прави Лукойл? : e-vestnik.bg," http://e-vestnik.bg/2879, accessed February 2012.

One thing can be said for sure. Lukoil has a great influence on the local Bulgarian market. To go further into detail would be mainly speculating, which cannot be backed up with reliable data. But what this means is that the daily wholesale prices listed by Lukoil can be used as a local benchmark. The focus of this thesis will be namely the Lukoil prices and the use of derivatives to manage risk.

## 5.3 Local Benchmarks

In fact, most of the physical oil product trades in Bulgaria are related with the prices, which are listed on the official internet address of Lukoil (www.lukoil.bg). Distributors and other major clients of the company receive a price that is subtracted from the current Lukoil quotation. For example, the biggest distributors may receive a discount of up to 90 BGN (about 45 euro) or more. This is referred to as “Lukoil minus 90.” Also, in domestic trade, fuel prices are formed by quoting today’s price and adding a margin, for example - “Lukoil plus 50.”

The other local benchmark is Platts. But as there is no Platt’s assessment for a region in Bulgaria, the Platt’s FOB Med High quotations are used instead. FOB MED refers to the Free on Board cargoes based in the Mediterranean. Usually, the highest quotation for a certain product is chosen to cover eventual price risk.

But these two local benchmarks present a problem concerning their geographical position. One is located near the coast of the Black Sea in Bulgaria. The other is regarding all physical oil products traded in the Mediterranean. To take the prices, for example in Italy, and to relate them to the prices in Bulgaria would require much effort. Logistics, transportation costs, storage costs, and transaction fees will have to be taken into consideration. Also the timeframe from loading to unloading the cargo will cause considerable investments.

Instead, Platt’s is used in Bulgaria as Brent is used on ICE. It is just a number, which usually relates the price of the imported oil products. But there are major discrepancies between Lukoil and Platt’s. One of them is the type of crude that is used for the finished products.

Mediterranean refineries usually process crudes from the Gulf (Figure 8). Lukoil, on the other hand, is processing Russian Export Blend Crude Oil (REBCO). These are actually dissimilar grades of crudes, whose parameters vary. If we go back to crack spreads, it is clear that from one barrel of crude specific quantities of finished products will be produced. This depends on the chemical properties of the crude and on its distillation curve.

Another interesting fact is that Russian Export Blend has relative low levels of gasoline fractions, according to Prof. Ivanov.[133] Gasoline starts to boil from 300℃ upwards. This means that there is a considerable amount of diesel/gasoil fractions, but almost no gasoline. This is what can to some point explain the oil market paradox in the winter of 2011/12 in Bulgaria. Diesel fuel was at some times with over 7 Euro cents more expensive than gasoline (Table 3), although the fact that the imposed government taxes on diesel are lower. But there are also other reasons, except crack spreads, like seasonal demand and financial market influence. Also, it can be pointed that the technical level in the Burgas refinery, does not allow for the complete processing of crude oil. Thus, some quantities remain in the form of

[133] Ibid.

heavy residues like fuel oil. As this is a relatively cheap product, it is believed that it is loaded directly on ships and sold on other, international markets.

The second major difference between Lukoil and Platt's as benchmarks is the quotations of the prices. The finished and semi-finished physical oil products assessed by Platt's are always in $/tonne. Lukoil offers its wholesale products in BGN/1000 litres or in the case of Fuel Oil – in BGN/tonne. Converting USD in BGN and vice versa leaves enough room for currency risk and this is why it will be discussed later in the following parts of the thesis.

To pinpoint the financial influence in the world of oil, a look in the following table will be helpful.

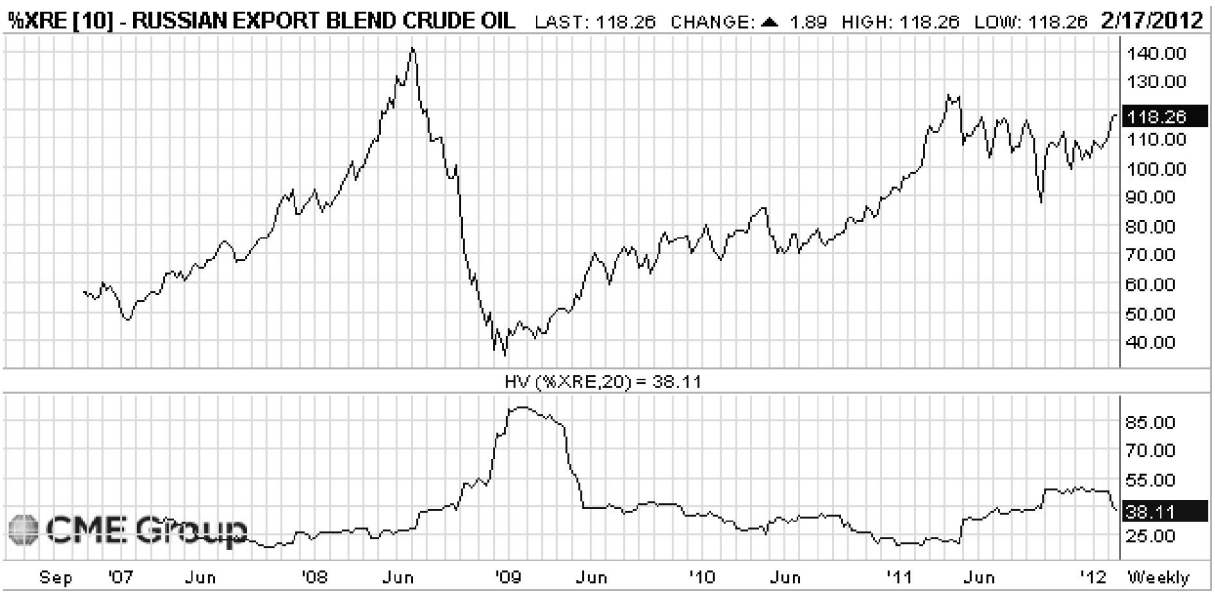


**Figure 14 Russian Export Blend Crude Oil financial futures and historical volatility 2008-2012**[134]

The price movement pattern reminds that of Brent Dated in the same period (Figure 1). As REBCO futures were firstly introduced to CME ClearPort in 2008, this crude grade quickly shared the destiny of other grades, namely an innate volatility that no one can easily predict. This is why it is important for the common Bulgarian trader to understand what is actually happening in the world oil market and to know how to protect himself from price risks.

## 5.4 Market Analyses and Lukoil Prices

This part of the thesis will deal with the relationship between Lukoil prices and the Platt's FOB Med High quotations. In this way, different oil products will be compared and analysed. The main goal is to find similarities and/or peculiarities and to propose hedging strategies.

First of all, it is important to convert all products in the same unit. The methodology to convert Lukoil prices from BGN/1,000 litres into USD/mt is the following:

[134] CME Group, "CME Group - Charts: April_2012_REBCO_Financial," http://www.cmegroup.com/popup/mdq2.html?code=XREJ2&title=April_2012_REBCO_Financial&type=p#period=W;link=monthly;month=00;year=8;bartype=LINE;bardensity=HIGH;study=HV, accessed February 2012.

$$\text{Lukoil}\left[\frac{\text{USD}}{\text{mt}}\right] = \frac{\text{Lukoil}\left[\frac{\text{BGN}}{1{,}000\text{litres}}\right]}{\text{Density}\left[\frac{\text{g}}{\text{m}^3}\right]} \Big/ \frac{\text{USD}}{\text{BGN}}\ \text{Exchange rate}$$

To convert BGN/1,000litres in USD/mt it is necessary to determine the product's density at 15℃ and the exchange rate of the day. Because the density of each product is not specified and it varies in a certain range, commonly used densities in the practice will be used. These will be stated for all products in the following short summary. The exchange rate used for the analysis is the official exchange rate of the European Central Bank (ECB) for USD/Euro. Because the Bulgarian national currency (BGN) is pegged to the Deutsche Mark (DM) since 1999, there is a fixed exchange rate for BGN/Euro. One Euro is equal to 1.95883 BGN. This makes the conversion of BGN in USD rather simple.

The **volatility** for each product will be given as the historical volatility for 20 days (HV 20), which is approximately the number of working days in one month. The number of working days in one year will be considered to be 252. This number can vary according to the person who is using it. Some prefer to choose a number in the range 250-260. Others may want to consider the entire 365 days in one calendar year. But as Lukoil makes no changes in prices on weekends, the number of days in one year in this analysis will be 252. Volatility will be calculated as the standard deviation of the natural logarithm (LN) of the difference between two prices for a range of 20 days, which is then multiplied by the square root of the number of days per year (252). In this case, the historical volatility will be calculated and plotted with the help of MS Excel©.

The **differential** will be calculated as the daily difference between the prices of the two chosen products and will be plotted together with the two sets of chosen prices and the exchange rate.

Furthermore, all Lukoil prices are pre-tax and with no added excise. Platt's assessments are based on semi-finished or finished products. This means that some products like diesel fuel and gasoline are not blended with bio components or additives.

The period of time that is going to be concerned in this analysis is from 2010 till the time of writing. This is mainly due to high price fluctuations from 2008-2009, which were caused by the financial crisis. Also, as Bulgaria entered the European Union in 2007, some new regulations regarding the chemical properties of petroleum products have been imposed. This means that the period from 2010 onwards can be considered as the best one to analyse.

### 5.4.1 Market for Gasoline and Diesel Fuel

**Retail Market**

Gasoline and diesel fuel are the major fuels in the automotive sector. But the retail market for these fuels has already been shared between the major oil companies. This leaves little room to find market gaps and low-risk profits. Also, entering the local retail market would require considerable investments in gas stations and storage facilities.

From Table 16 can be seen that the major local oil companies control the retail market. This leaves plenty of room for speculations about cartel and price agreements. Also, as the actual market share is rather unknown and varies according to different sources, many uncertainties can come from trying to enter this market. There are also many other privately owned small gas stations. But their market share is negligible. Also, there are rumours that a certain energy concern is going to enter the Bulgarian local market soon with its brand of gas stations.

**Table 16 Bulgarian retail market for gasoline and diesel fuel**[135]

| Company | Income in million BGN | | Profit in million BGN | | Number of gas stations | Market share % |
|---|---|---|---|---|---|---|
| | 2010 | 2009 | 2010 | 2009 | | |
| Lukoil Bulgaria | 3331 | 3178 | 5,91 | 6,69 | over 200 | 26 |
| OMW Bulgaria | 1622 | 1255 | 33,5 | 22.00 | 92 | 21-22 |
| Petrol AD | 1126 | 1024 | 2,3 | -15,5 | 400 | 25-30 |
| Shell Bulgaria | 499 | 466 | 17,9 | 13,1 | 112 | 16 |
| EKO Bulgaria | 391 | 295 | -0,62 | -5,26 | 81 | 9 |
| Rompetrol Bulgaria | 337 | 275 | 1,87 | -2,4 | 60 | 4 |
| Sinergon Petroleum | 121 | 56 | 1,12 | -0,34 | 30 | 2 |
| **Total** | 7427 | 6549 | 61,98 | 18,29 | 945 | |

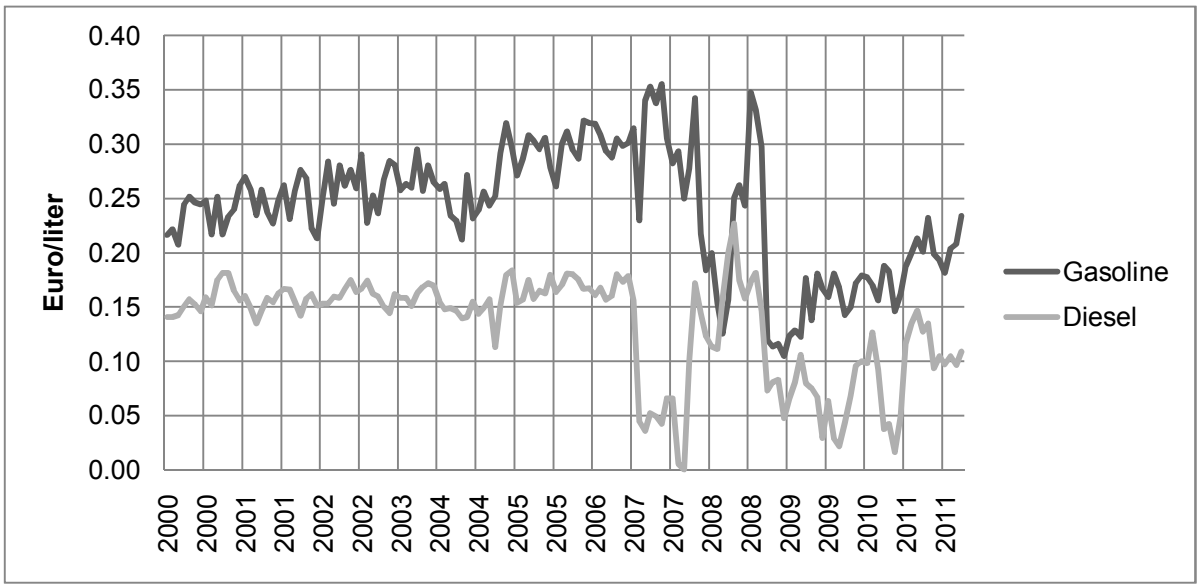


**Figure 15 Average European minus Bulgarian retail prices for gasoline and diesel fuel 2000-2011**[136]

[135] "Лукойл България с най-големи продажби сред веригите бензиностанции през 2010 г. :: Investor.bg," http://www.investor.bg/novini-i-analizi/339/a/lukoil-bylgariia-s-nai-golemi-prodajbi-sred-verigite-benzinostancii-prez-2010-g,122942/, accessed February 2012.

[136] Europe's Energy Portal, "Europe's Energy Portal » Fuel Prices, Rates for Power & Natural Gas," http://www.energy.eu/#fueltaxes, accessed February 2012.

Figure 15 shows the price difference between the European average and the Bulgarian local retail prices. What can be seen is that the gap between the two has actually been reduced in the last years. Also, it is important to note that the taxes and excises on oil products in Bulgaria are much lower than the EU average.

**Wholesale Market**

The wholesale market, on the other hand, allows for more flexibility. This is why some traders prefer to buy the semi-finished products, blend them in their production or storage facility with bio components or additives, and sell them on the market. They could also just buy and resell a certain product but, in most of the times, they will be able to obtain a rather small margin. This is due to the fact that by a simple blending or colouring of a product, the profit margin can increase considerably.

**Gasoline**

Gasoline is sold by Lukoil as A95H or A98H. The difference between the two is the octane number. The major oil companies on the local market have their own brand of gasoline. This is because they buy or produce the “pure” gasoline (RBOB) and then add their own additives and other blending components.

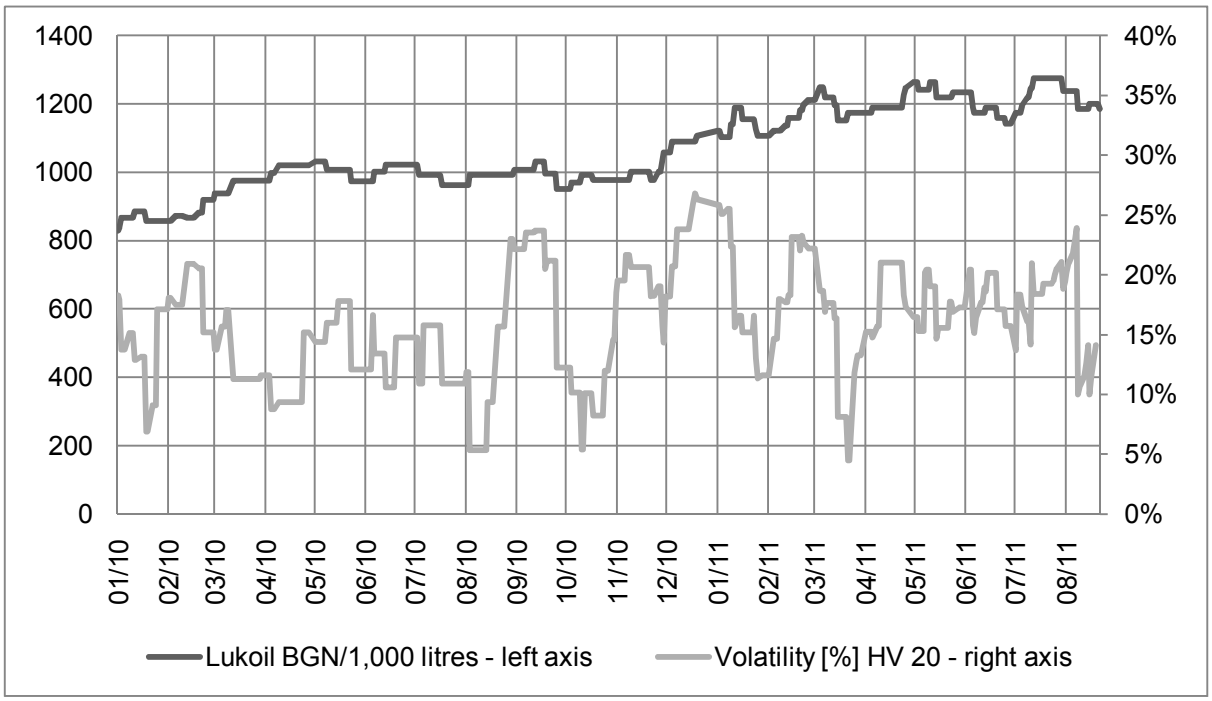


Figure 16 Lukoil A95H prices and historical volatility HV20

Figure 16 shows one of the peculiarities of the local Bulgarian market. It is, namely, that Lukoil may change the listed prices of the oil products only several times a month. Sometimes, there can even be large periods when the price remains unchanged. To take gasoline for example, there are periods from a couple of weeks when Lukoil is offering a constant price for this product. The volatility of gasoline is, thereby, considerably small, which means that the market can be considered as rather stable.

Another interesting detail is that the price of gasoline gas increases from January 2010 to January 2011 with about 250 BGN. And from that time onwards, there have been much more

small fluctuations. The price peaks in the summer of 2011 can be described as caused by the so called “driving season.” The demand for gasoline was greater than the demand for diesel fuel. As a result, more crude oil was refined to meet this demand. The quantities of over-produced diesel and middle distillates could then be hardly sold on the local, so international markets had to be found.

This seasonal demand is also greatly influenced by the geographical position of the country. Bulgaria is situated on a major traffic artery, which connects Western and Centre Europe with Turkey. Also the roads from north to south and vice versa are quite intensive.

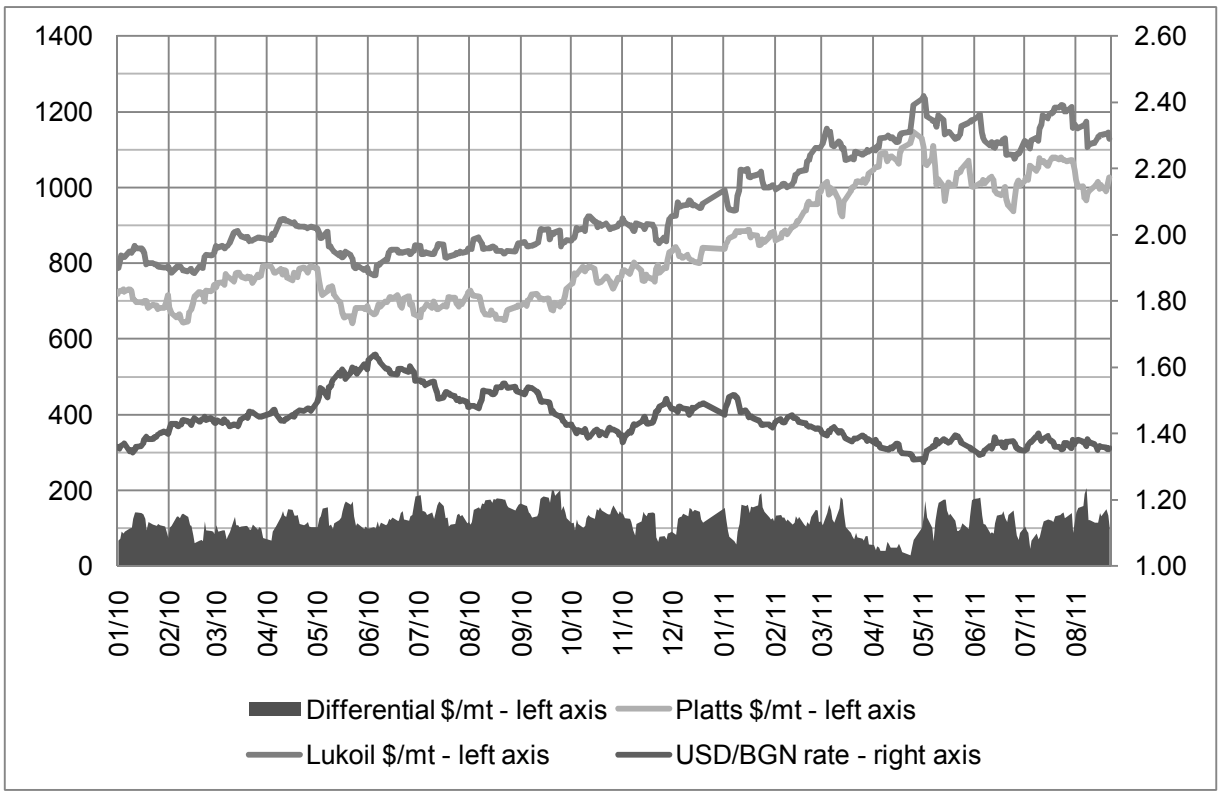


**Figure 17 Platts Premium Unleaded 10ppm and Lukoil A95H prices**

One of the details of the above figure that strikes first is the difference between the prices of Lukoil’s A95H and the Platt’s assessments for Premium Unleaded 10ppm. Both fuels have almost identical parameters. The level of sulphur contents of gasoline has been limited by the EU to 10 ppm. Both fuels have the same octane number – 95. The types of additives that are added to gasoline depend mostly on the producer. But this cannot explain the difference between both prices in the range of about $100 to $200 per metric tonne. Here, the discounts, which distributers and other big companies receive from the Lukoil price, may reduce this difference. But it still remains rather substantial. Maybe the difference between the grades of crude that are used for the production of gasoline can to some point explain this discrepancy.

But the price functions of both Lukoil and Platt’s follow a similar pattern with a correlation coefficient $r$ = 0.9727. This can be caused by the possibility of Lukoil to use the Platt’s assessments to price its products. It is also logical for an energy giant such as Lukoil to use derivatives to hedge its supply and demand chains. Also, one of the big trading and risk management companies is Litasco, which is part of the Lukoil Group.

This leaves plenty of room for speculation about how is Lukoil Bulgaria pricing its products. One thing is for sure, the pricing formula for each product that comes from the distillation tower is very complicated and it can be written down on a considerable amount of pages. There have also been rumours that the headquarters of Lukoil in Moscow have taken some control over the pricing of the oil products in Bulgaria since 2011.

One of the important factors for the pricing of any product on the market is the current exchange rate. Because Platt's assessments are in USD and Lukoil prices are in BGN, these have to be converted by applying the corresponding exchange rate. From Figure 17 can be seen that when the USD is gaining on the BGN (respectively on the Euro), the price differential decreases. This is what is regarded to as currency risk. It is one of the major risks in oil trade. When, for example, a company is buying gasoline from an international partner at a USD/BGN rate of 1.3 and is reselling it domestically at a rate of only 1.2, this company will face losses according to the degree of rate difference. The company will receive less USD from converting back the BGN received on the local market than initially invested.

At this point it is important to comment the decision that was taken between the Bulgarian government and Lukoil in the early 2011. Because the prices at gas stations were considerably high and the market was in a form of contango, Lukoil accepted to "freeze" the retail prices for one month. The effect can be clearly seen in Figure 17. Between April and May 2011, the gap between Lukoil and Platt's prices got narrower. The difference was in the range of about $30 to $70. It is unknown if Lukoil was selling at a loss. But local traders had to cope with the decreased margin between the two benchmarks. This is a classical case of political and regulatory risk. With its decision, the Bulgarian government locked the fuel prices for its citizens. But it also made the ways of doing business in the local oil sector more complicated. If traders did not effectively hedge prior this decision, they could face considerable losses. This is one of the many examples why the world of oil is so unpredictable.

**Diesel Fuel**

Diesel fuel is the other major automotive fuel. In this section, only the "pure" oil product will be discussed, which has no bio components. To begin, diesel offers more possibilities for traders to adjust their strategy. As the minimum requirement for bio diesel has been increased to 5% since 2012, diesel fuel can be bought "pure" or as a finished fuel for burning in automotive engines. The process of blending/mixing can be profitable, if managed reasonable. But this process requires certain investments in the form of extra storage facilities and mixing equipment.

Also, diesel is more preferred than gasoline by traders because there is a bigger market for this fuel. It can be used in vehicles but it can also be used for burning and heating. The final step of the energy cycle of diesel depends mostly on which market is more profitable. Because market trends are rather unpredictable and tend to change fast, diesel and other middle distillates belong to the most traded in Europe. This can be confirmed by the fact that there are Gas Oil futures on the ICE and Heating Oil futures on NYMEX. And diesel is nothing more than gasoil, but of better quality.

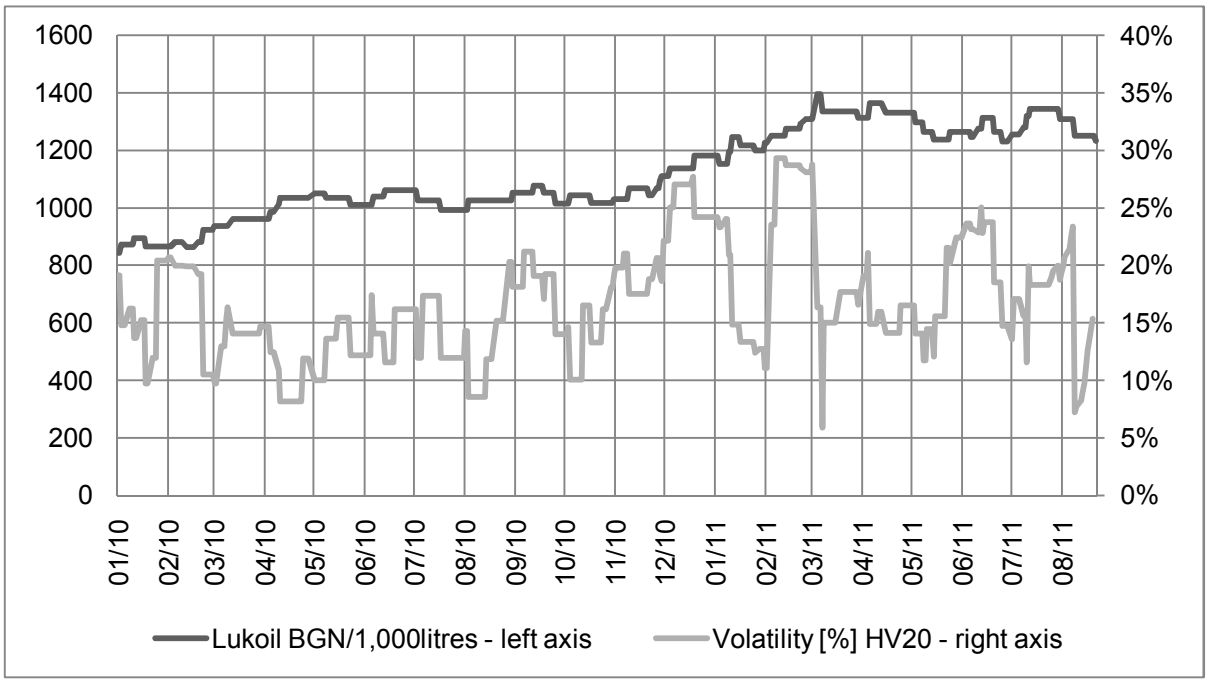


**Figure 18 Lukoil prices Diesel 10ppm and historical volatility HV20**

Figure 18 shows very similar patterns of price movements between diesel and the gasoline in Figure 16. The Lukoil prices are not changed regularly and there are periods of time when the diesel prices remains at an almost constant level. There are some price peaks in the winter of 2011/2012. But these can be explained with the higher demand for diesel in Bulgaria and in Europe as a whole. Also, since then, the volatility has slightly increased. This could be a sign for a more turbulent market, or it could mean that Lukoil is reconsidering its price more regularly. Maybe the biggest peculiarity is the price increase from about 400 BGN from November 2010 till March 2011. This can be explained with the cold winter months in Bulgaria in the last years.

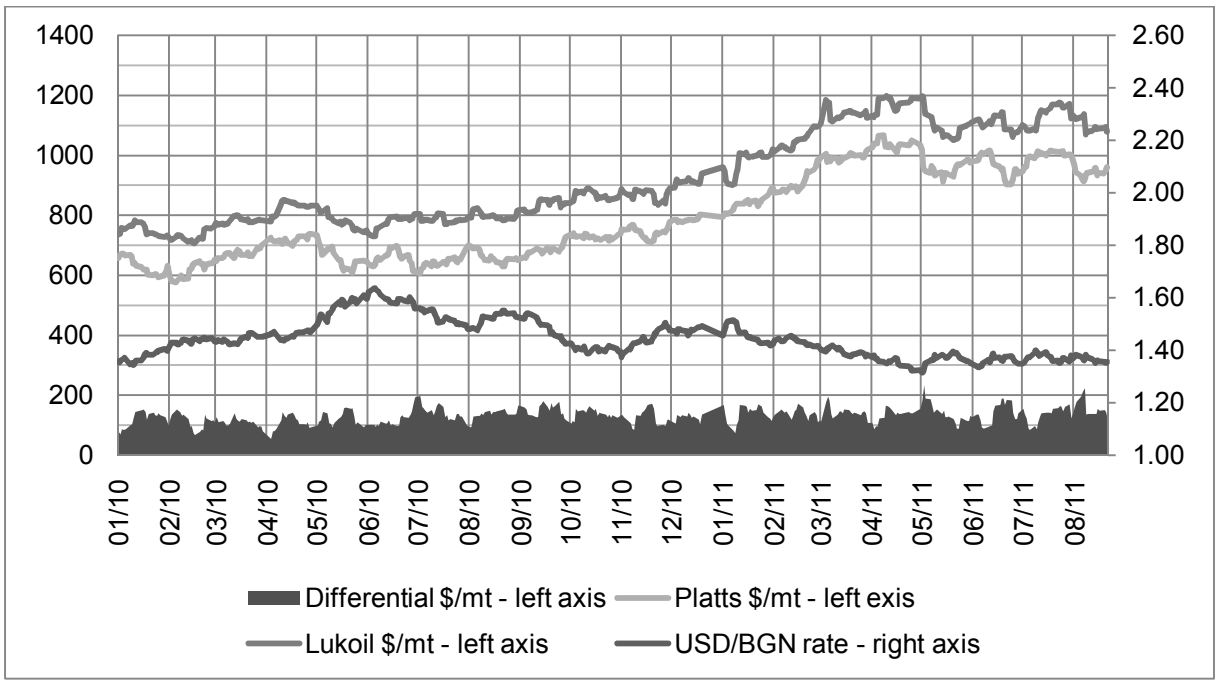


**Figure 19 Lukoil and Platt's diesel 10ppm prices**

The graphic above confirms the theory that Lukoil may be using Platt's as a benchmark to price its own products on the Bulgarian local market. The differential remains most of the time in the frame of $100 to $200 per metric tonne. The "locking" of retail prices from the Bulgarian government in early 2011, however, did not result in a drastic drop between Platt's and Lukoil price ratios, as was the case by gasoline. The fluctuations of the differential are mostly due to the change in USD/BGN exchange rate.

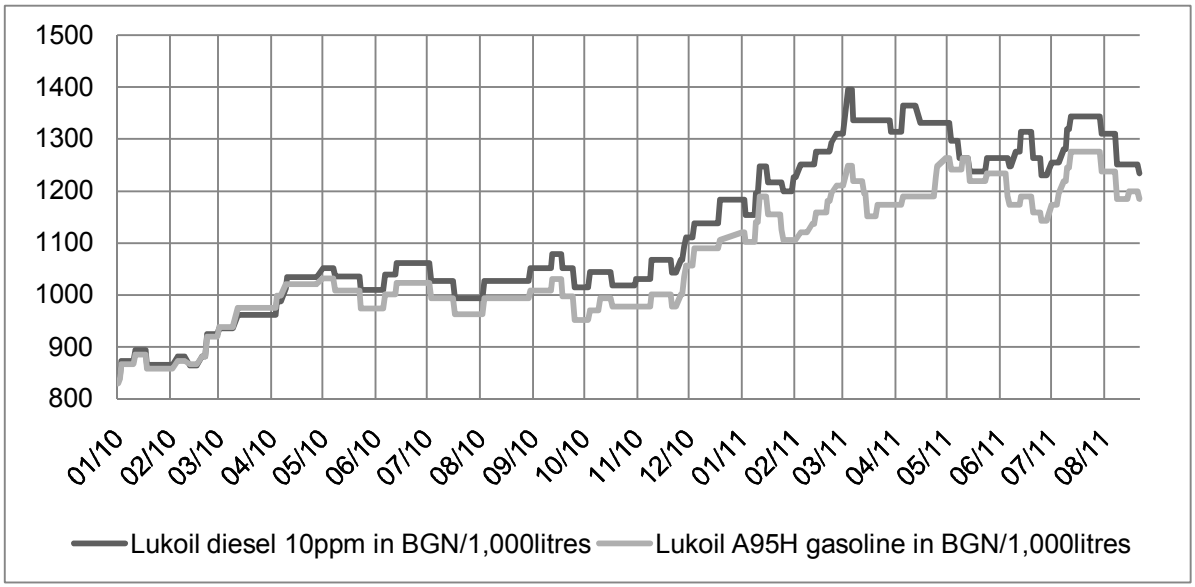


**Figure 20 Lukoil gasoline and diesel 10 ppm pre-tax prices**

The reason why the differential did not change drastically can be seen in Figure 20. It was because diesel fuel remained at the same price level and gasoline's price fell slightly. What is more disturbing is the fact that diesel was much more expensive starting from January 2011 till May 2011. This difference exceeded 200 BGN in April. This can once again be explained with the crack spreads and the low quantities of gasoline fractions in the refined by Lukoil crude oil.

As a total, both markets for diesel and for gasoline are experiencing more price fluctuations since the beginning of 2011. This means that hedging can be useful for some market participants.

### 5.4.2 Market for Jet Fuel

The market for aviation fuel in Bulgaria consists of aviation gasoline and Jet. Aviation gasoline differs from normal gasoline in its higher octane number, type of used additives and the stricter requirements. This is needed to provide security for pilots and passengers. The market for aviation gasoline is negligibly small, as it is used only by small private or agricultural aircrafts.

Jet, on the other hand, is burned in commercial airplanes and military aircrafts. Its chemical properties must be strictly held in norms and are constantly monitored to ensure they meet all the requirements. This is one of the reasons why traders often do not want to deal with this product. They have to import it from abroad and build special storage facilities. Also, most clients demand special quality certificates, which can be hard to obtain. Another reason

is that, for example, jet fuel auctions for military purposes, which require special guarantees and warranties for large periods of time.

This is why the only distributor for Jet in Bulgaria is Lukoil. The refinery in Burgas supplies the whole country with this fuel. There, of course, can be quantities of imported jet. But they will be rather small. One of the main reasons is that jet can hardly be transported with ships, as small ships and barges are used for other, darker and heavier fuels. This means that the vessel has to be “cleaned” every time a cargo of jet is going to be shipped, in order not to damage the quality of the product. This leads to the conclusion that jet can only be imported to Bulgaria via trucks or railway compositions, which are more expensive than shipping in terms of transportation costs.

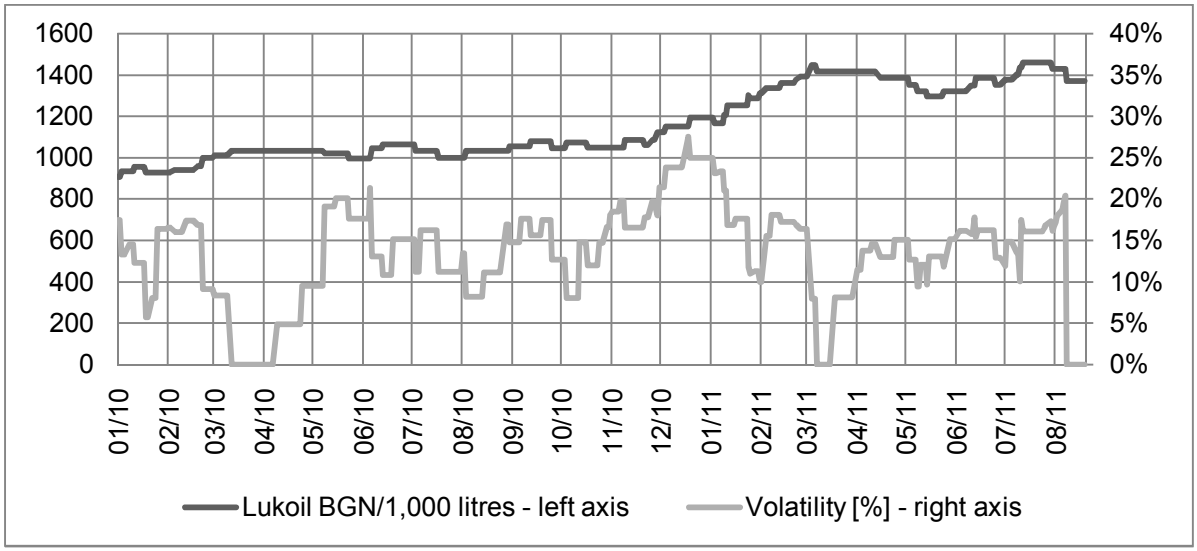


Figure 21 Lukoil Jet prices and historical volatility HV20

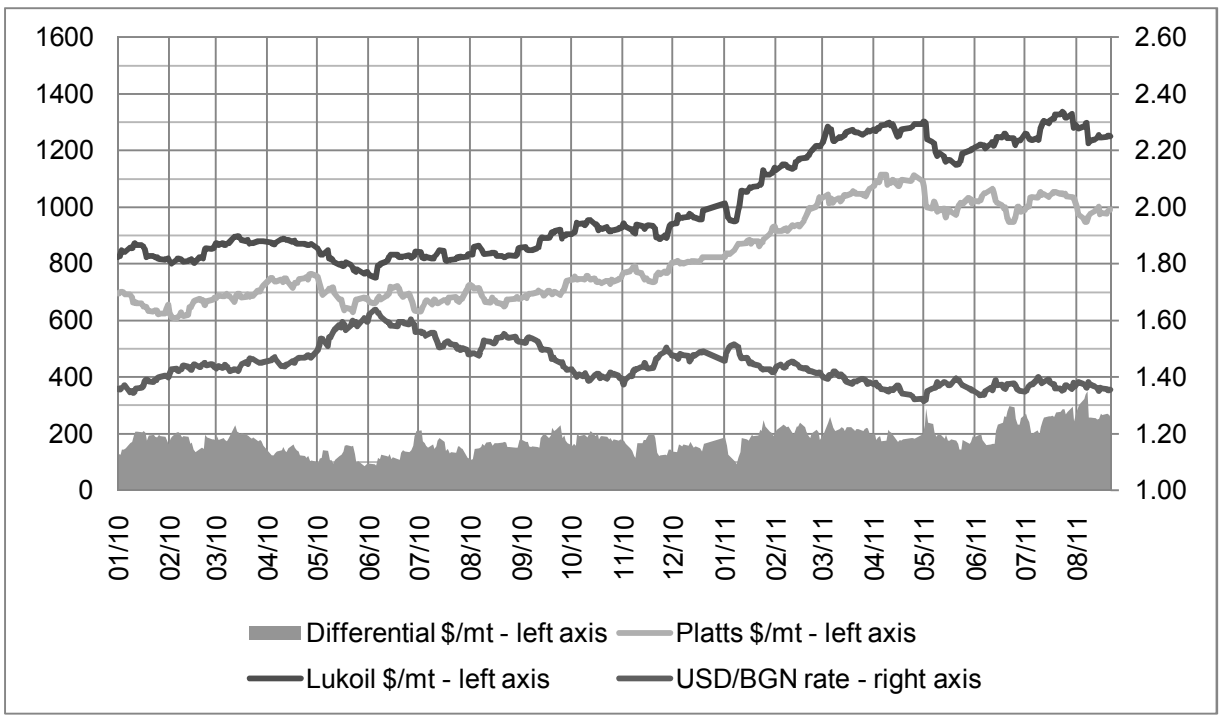


Figure 22 Lukoil and Platt's Jet fuel prices

The Lukoil jet prices have not changed much in the last two years. Only one steady increase from November 2010 to March 2011 can be seen in Figure 21, where the prices increased from about 1000 BGN to 1400 BGN for 1,000 litres. This is the time when all prices were "frozen". From then on, jet followed a rather stable pattern.

The difference between Lukoil and Platt's remains the usual in Figure 22. But it can be seen that it is slightly bigger than that by gasoline and diesel. Also, since mid June 2011, this difference exceeded $320 per metric tonne. This can be due to the above mentioned reasons, as jet fuel is expensive to transport and store. But as Lukoil is the biggest distributor with its company Lukoil Aviation, it can easily price the jet it produces as it pleases. But the fact that there is a considerable gap between Lukoil prices and Platt's quotations makes this market quite lucrative.

Jet fuel caused for some big debates in Bulgaria recently. In the end of July 2011, the Bulgarian government deprived "Lukoil Neftochim" of their licences to process petroleum products. The reason for that was because the company had not installed the required by government law equipment. The purpose of this equipment is to allow the customs agency to monitor in real-time what products are going in and out of a fiscal storage. It consists of debit and level-meters, which are connected online via software with the customs.

This event was a shock for everyone in the country. Countless of debates were held on national televisions regarding this issue. In the end, Lukoil won the lawsuit against the government and received its licence back. This event also served as inspiration to write this diploma thesis, as not much is known what is actually going on in the local Bulgarian market.

Because Lukoil had no licence, the company could not produce jet fuel to meet the domestic demand. People began to worry that some airports will not be able to receive enough jet. Importing this fuel on a short notice would radically increase its price. This is considered to be one of the reasons, why Lukoil was awarded back the licence. After all, refineries are considered to be of strategic national importance.

### 5.4.3 Market for Gasoil and Fuel Oil

Gasoil and fuel oil need to be further processed in order to recover the more valuable fractions. This can be done by cracking, hydrotreating or another refining process (see Chapter 3.1.2). But these processes require large investments, which can sometimes be difficult to pay off over the long run.

But thorough vacuum or atmospheric distillation, some of the valuable fractions can be also recovered. However, some part of the product feed will remain under the form of heavy residue. It all depends on the resource that is used and on the technological level of the distillation tower.

This is actually what some small companies in Bulgaria are doing. They can buy semi-finished products or heavy residue, refine them through simple distillation, and obtain more valuable products that can be sold on the local market. But to construct and operate even a small distillation column usually costs a seven digit figure. Also, a network of storage tanks and pipelines for different finished products and fractions has to be constructed.

But once having such a petroleum base, companies can become quite competitive on the local market. By importing the required products and by processing them, they can achieve a lower price than the price offered by Lukoil. This is why gasoil and fuel oil are important to this part of the local oil market.

It is important to note, that the prices, which are used for gasoil and fuel oil, are not completely accurate. As mentioned earlier, Lukoil is exporting a big part of its heavy products. This is why occasionally there have been no listed prices for these products, or the listed products have had different parameters than the ones assessed by Platt's. And since 2012, Lukoil is not offering fuel oil on its official website.

The data provided in this part of the thesis will be used to offer a general view of the market, as it is considered by some to be advantageous in the moment of writing.

**Gasoil**

Gasoil and diesel are almost identical products. The difference is that gasoil has worse parameters. One of them is the excessive sulphur quantity. As gasoil is mostly used for heating, the maximum allowed sulphur content is limited to 0.1%. Diesel, on the other hand, is limited to 10 ppm, which corresponds to 0.001%S. This is 100 times more than by gasoil.

But there are gasoil products on the international market that have sulphur contents a little over this limit. Sulphur content is a quantitative parameter, which means that by mixing a low-sulphur with a high-sulphur product, a product with medium sulphur contents can be obtained. This must sometimes be done through a distillation tower. In this way, buying a cheap gasoil product with high sulphur content and mixing it with a better one, a compromise between price and quality can be achieved.

Gasoil is mainly used for heating purposes and this is why it has a lower excise base. The excise for diesel in 2012 is 630 BGN/1,000 litres, and for gasoil – 50 BGN/1,000litres. Because it is very similar to diesel, it has to be coloured with special solvents. It is usually coloured in red, but there can be blue or yellow gasoil products, which are used for other purposes. This is done to avoid tax evading and it is a common praxis in Europe. For example, gasoil for heating in Germany is called Heizöl and is coloured also in red.

There is a big market for gasoil in Bulgaria, especially in winter. Many hotels, kindergartens, schools, government buildings, municipalities, and many other need this product in the cold months.

As it can be seen from the two figures below, the price patterns of gasoil follow those of the previous Lukoil products with little exceptions. Gasoil seems less volatile and the differential in the last three months in Figure 24 is slightly higher than that of gasoline and diesel.

Not to forget, the USD/BGN exchange rate has had an effect of all the products so far. Sharp spikes of this rate have led to the corresponding falls in the Lukoil price. This is due to the methodology, which is used. But when the rate is compared to the Platt's quotations, the two functions are somewhat "mirrored."

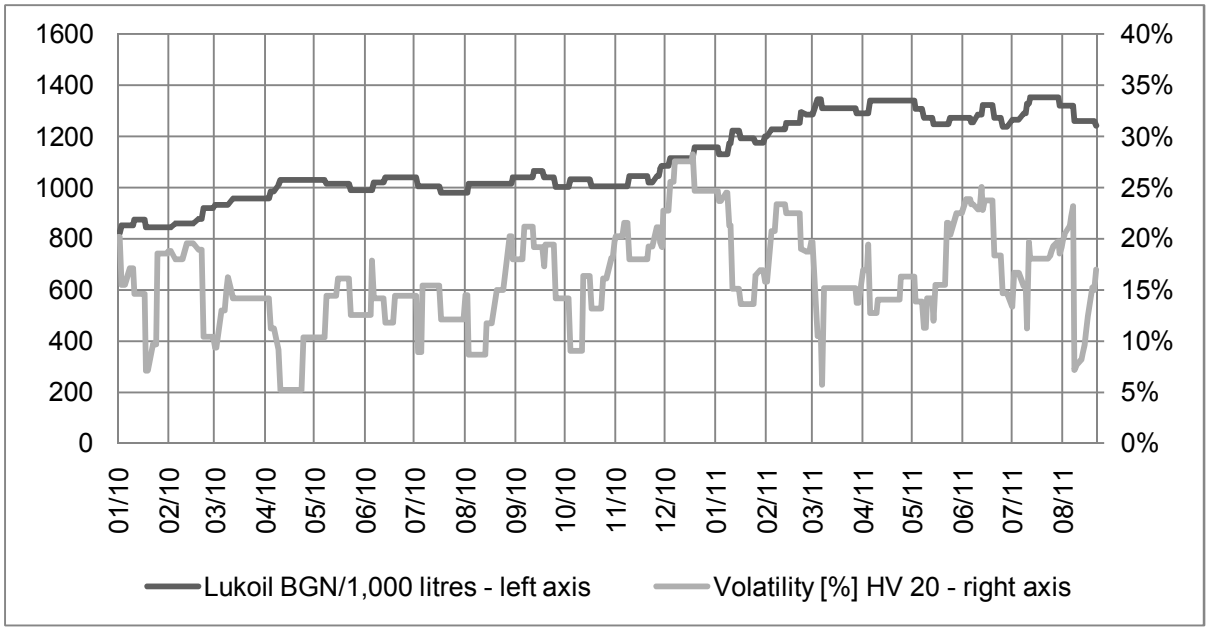


Figure 23 Lukoil gasoil 0.1%S prices and historical volatility HV20

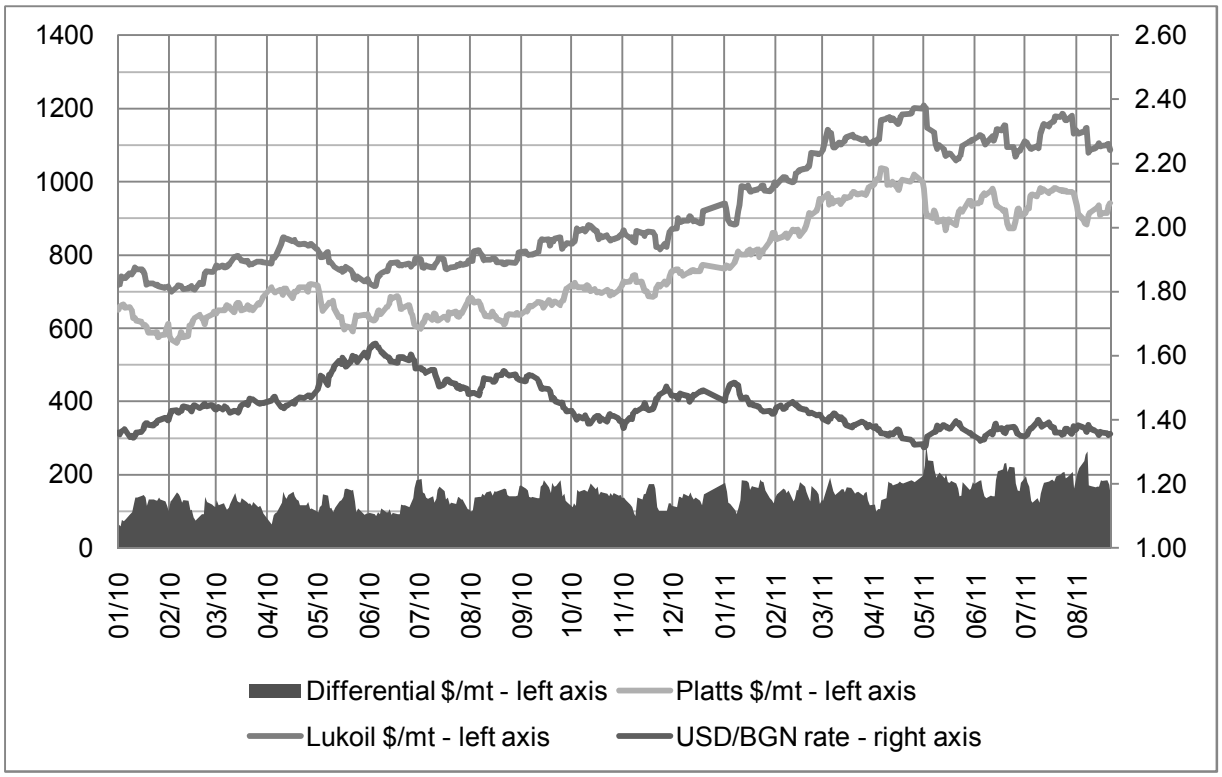


Figure 24 Lukoil and Platt's gasoil 0.1%S prices

### Fuel Oil

Fuel oil is everything that cannot be further processed due to the technological level of a refinery. This is called the bottom or residue. But fuel oil can be used for industrial burners, ship fuels and in some power plants. The market for this product can be described as moderate. There are not many clients for fuel oil, but the quantities they need are usually big. Sometimes, a whole railroad composition can be shipped to a client to meet his demand.

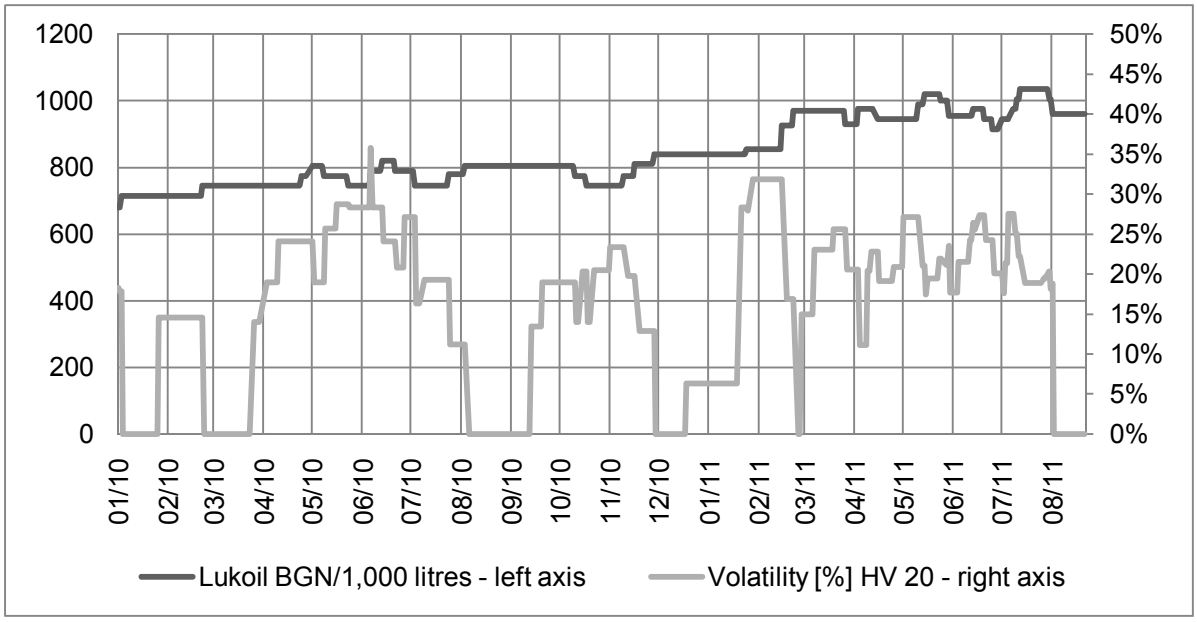


Figure 25 Lukoil fuel oil and historical volatility HV 20

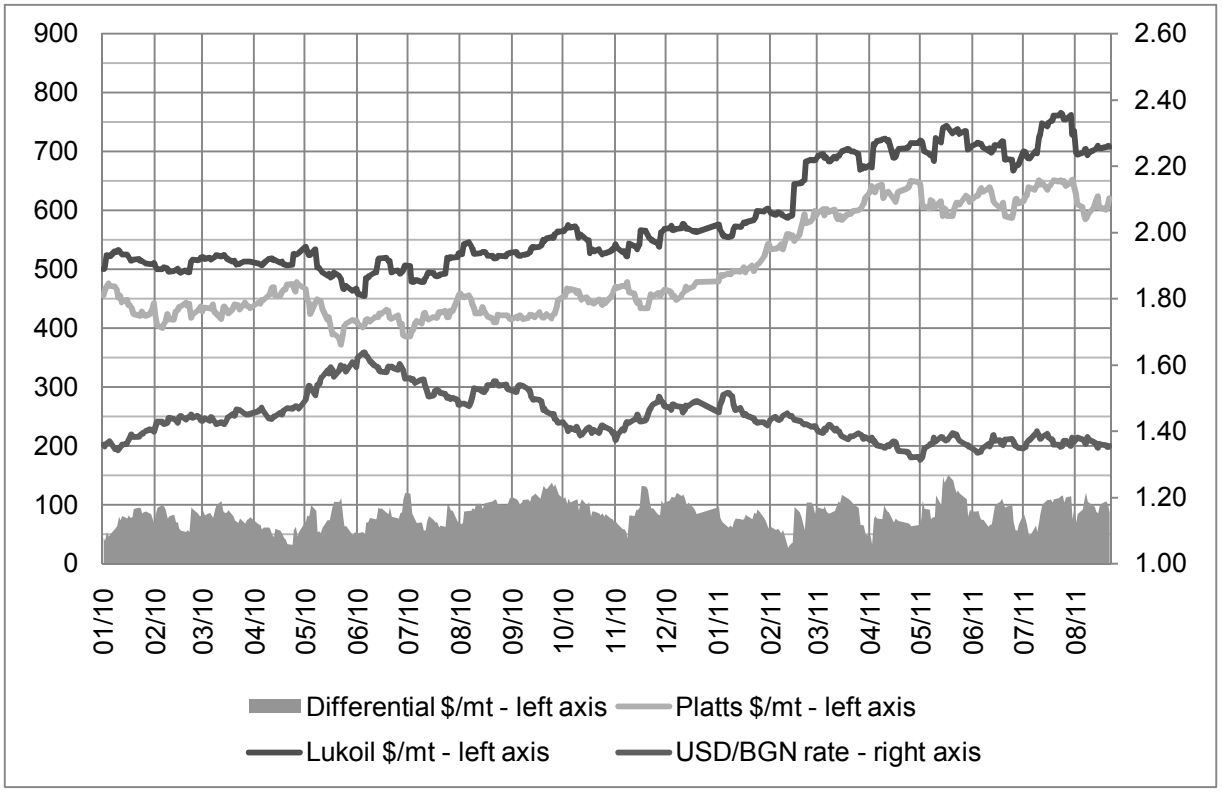


Figure 26 Lukoil fuel oil and Platts fuel oil 3.5% prices

Lukoil is exporting a lot of the heavy ends by sea. Fuel oil is a major part of these exports, which means that there can be demand for this product on the local market. Lukoil is also planning to build a new processing centre by 2015, which will be able to process fuel oil and obtain gasoline, gasoil and diesel. The market in the near future is unclear, as more and more of the clients that used fuel oil are switching to natural gas. But till then, as all product prices listed by Lukoil, fuel oil is with about $100/tonne more expensive than the Platt's FOB Med High assessment.

### 5.4.4 Short Summary

All prices of the major physical oil products, listed by Lukoil in Bulgaria, are higher than the Platt's FOB Med High assessments for the corresponding product. This differential is most of the time in the range of $100 to $200 per unit. The correlation of all products is almost 1 and the volatility of Lukoil prices is low. There have been some peculiarities, which to some point can explain the related price changes.

**Table 17 Summary on Lukoil prices**

| | Density | Correlation | Average HV 20 | Average Differential |
|---|---|---|---|---|
| | g/m3 | Platts/Lukoil | Platts/Lukoil | $/mt |
| **Gasoline** | 0.775 | 0.9727 | 15.85% | 122.35 |
| **Diesel Fuel** | 0.845 | 0.9849 | 16.52% | 131.50 |
| **JET** | 0.810 | 0.9780 | 13.26% | 182.41 |
| **Gasoil** | 0.845 | 0.9822 | 15.96% | 145.80 |
| **Fuel Oil** | | 0.9673 | 15.77% | 85.57 |

Because Lukoil prices are considerably high, by buying on a reasonable Platt's based price and reselling or processing the product on the local market, a certain profit margin can be locked with the help of derivatives. But in order to construct a hedging strategy, there are some local risks that need to be considered first.

## 5.5 Local Risks

The major risks that the local oil trader has to face on a daily basis are price risk and currency risk. Price risk can come in many forms. It can be the sum of many expected and unexpected events. Currency risk is highly dependent on the international exchange rates for the major currencies. Because most of the global oil trades are done in USD, converting the dollar in the local currency and vice versa will sometimes cause loses because of the volatile exchange rate.

**Price risk** in the oil trade means that a product has a chance to decline in value. However, this product has also got a chance to gain in value, if certain events happen. This uncertainty can cause severe damage to a company over the long run. Sometimes there will be small or big losses and sometimes there will be small or big profits. If a sequence of several consecutive losses occurs, then the trader will have to take bank loans or credits in order to repair the damage caused in the company's portfolio. In this case, the trader may be faced with high interest rates, as the company will not be reliable. Also, by considering the time value of money, it may take years for the trader to get back on his/hers feet.

One of the most used methods to manage price risk is by using derivatives to hedge. But price risk could also be managed by insurance contracts, long-term contracts, or diversification. This means that a combination of some or all of the above mentioned methods can be formed, to satisfy a trader's needs. To conclude, the extent to which price risk is dealt with depends on the management of a company. It can be reshaped, transferred, or taken. But it could never be eliminated completely.

Because Lukoil does not change the prices of its products regularly, price risk may not be considered that great. There are periods, when the current price remains stable. Platt's quotations, on the other hand, vary every day. These fluctuations are considerably small. They usually lay in the range of $0.25 to a couple of USD. Only major economic or geopolitical events can cause these quotations to fluctuate greatly. But the changes Lukoil applies to its product prices are usually of about 1 to 2%. This accounts for fluctuations in the range of 30 to 60 BGN, sometimes even more. This pricing gap is what is actually troubling the local traders. Because Lukoil can increase prices almost without notice, the products they have imported will not be that competitive on the local market. This is why hedging these imports can be the solution to price risk.

It is also important to note that Lukoil has several petrol bases, which are situated near all of the major cities. Each of these bases has its own listed prices, which are most of the times identical to those, which are listed by the central base in Burgas. But there are two exceptions. The petrol bases in the capital Sofia and in Blagoevgrad usually offer lower prices for the major products like diesel fuel and gasoline. One of the reasons for this is, because these products are supplied to them via pipeline. This low-cost form of transport allows for cheaper prices. The other reason to offer lower prices is because of other market competitors. Sofia city can be considered as the biggest oil market in the country. Blagoevgrad, on the other hand, is closely situated near the border with Greece. Greece can import oil products on competitive prices. This is why, by reducing the profit margin of importers, Lukoil can gain positions on the local market. With its system of petrol bases, Lukoil can react to big imports, by reducing the product price for the corresponding region. This can substantially increase price risk for local traders.

**Currency risk** in the Bulgarian local market means that if the national currency (BGN) loses positions on the dollar, there will be an unfavourable price effect on the imported oil products. If a local trader imports, for example, 2,000 mt of diesel, he will have to pay for the cargo in US dollars. Supposed the price is $1,000/mt, the total sum would be $2,000,000. All big companies have accounts in different currencies. But sometimes it is not wise to keep large amounts of one foreign currency for such occasions. This is why the trader will have to buy USD by offering BGN to a bank. The exchange rate of the day can be quite volatile. After all, foreign exchange is one of the biggest markets, which is characterized by high volatility.

If the exchange rate for the day is 1.3, the local trader will need 1.3 x ($2,000,000) = 2,600,000 BGN to purchase the cargo. Supposed, the trader has received and sold the whole quantity. He will receive BGN on the local market, as this is the national currency. To initiate the next trade, this local trader will once again need USD. But as he has received BGN, he will need to exchange BGN in USD. However, there is a period of several weeks since the first exchange. This means that the exchange rate could be higher or lower than 1.3.

If it is 1.4, the trader will need 1.4 x ($2,000,000) = 2,800,000 BGN to purchase the same cargo. But this will be 200,000 BGN more than the previous trade. So, the trader will need to pay this difference in order to receive the same product again. This is currency risk. Of course, the exchange rate could be better than 1.3. It all depends on the day. Because the trade is usually cash settled one or two weeks after the cargo is received, the trader can chose the time of exchange. If he waits for a more favourable exchange rate, he will risk

having to exchange at an unfavourable rate on the last possible day. The trading process can be seen in Figure 27.

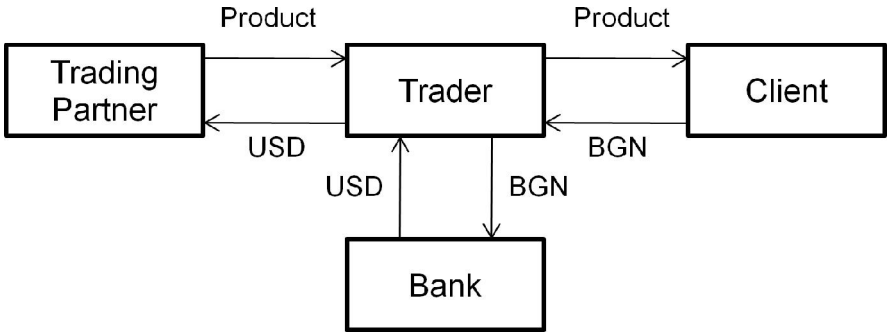


Figure 27 Trading process

Currency risk can pose considerable danger in any trade. But this risk can be managed with the use of derivatives. This can be done in the same way like hedging crude oil and oil products. The foreign exchange market comprises of enough exchanges and offered products. Because the BGN is pegged with the Euro since 1999, Eurodollar products can be used instead of the national currency. Also, banks can be a suitable partner in OTC derivative products trading.

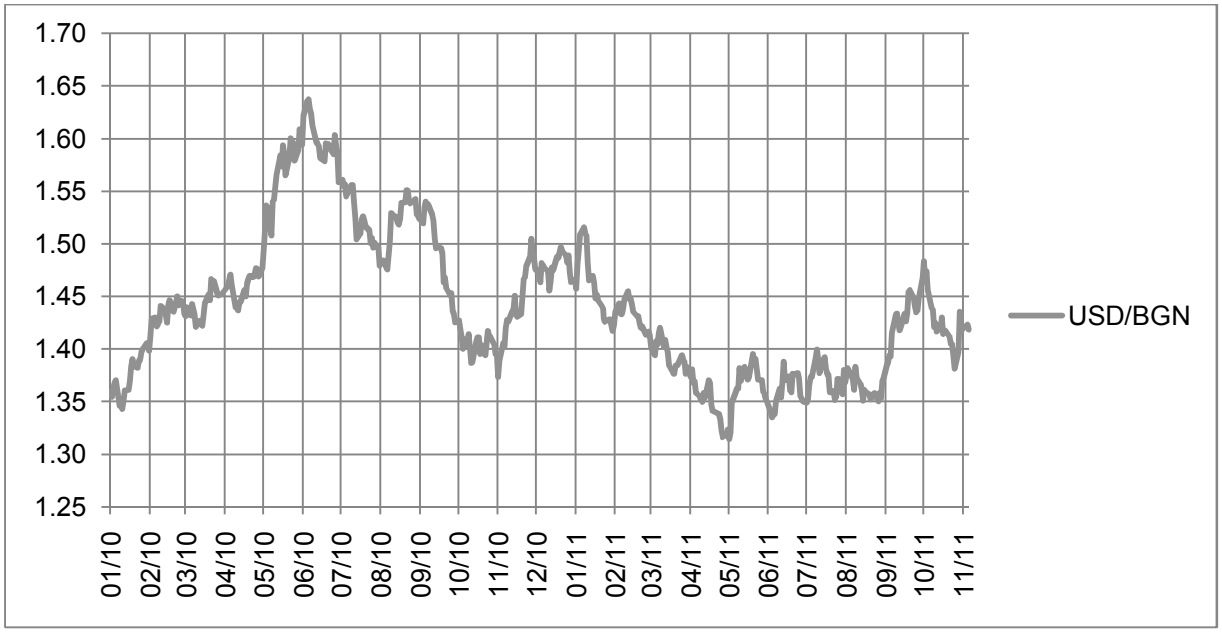


Figure 28 USD/BGN exchange rates ratio 2010-2011[137]

As it can be seen in Figure 28, the USD/BGN exchange rate is very volatile. With many issues concerning the stability of the Euro zone, this volatility is expected to last for a long period of time. Although Bulgaria is not a member of this zone and it is not using the Euro as national currency, the Bulgarian Lev (BGN) is closely related with the Euro. This is because it is pegged with the Deutsche Mark and is, therefore, exactly 1.95583 Euro.

[137] ECB, "ECB: Euro foreign exchange reference rates," http://www.ecb.int/stats/exchange/eurofxref/html/index.en.html, accessed September 2011.

Hedging this exchange rate in Bulgaria could be a problem. Traders will need to develop separate currency hedging strategies. Combining them in practice with the hedging of oil products could lead to mistakes. After all, derivatives are regarded as “weapons of mass destruction.” One large mistake could lead to substantial losses.

Banks in Bulgaria usually do not wish to engage themselves in OTC trades. If they do, they will demand high options prices or rather unfavourable forwards contracts. This can be explained with the low credit rating of domestic banks. Also, branches of multinational banks would need to get the approval of the banks’ headquarters before they could offer a derivative product. The issue of Mr. Kerviel and Societe Generale in 2008 (chapter 4.3.5) has made many banks be more careful when offering OTC products.

**Liquidity risk** is one of the obstacles in local trades. One of the reasons is that trades are sometimes settled with delayed payments. This means that the timeframe between selling and receiving the payment can expand over a couple of weeks or even months. Some of the clients may also be reselling to other smaller clients. Thus, a chain of delayed cash flows is created. There can even be cases of no-payments. It is also important to note that the normal Bulgarian client is not characterized by a high purchasing power.

High **credit** (also **default** or **counterparty risk)** is the result of the rather illiquid local market. There are big companies, but there are also many small ones. There are ways of dealing with this risk like:

- **Letter of credit**. This is a document, issued by a financial institution (usually a bank), to guarantee that one counterparty will make the obliged payment to the other counterparty of a deal. The fees are paid by the party that has to make the payment.
- **Bank guarantee**. The bank guarantees that the obliged payments will be made. If they are not made, the bank has to cover them. In oil trade, Letters of credit are more preferred than bank guarantees because they are constructed for a certain trade.
- **Factoring**. If a company fails to pay, the bank buys this debt. In Bulgaria, banks usually cover about 80% of the whole debt.

Credit Default Swaps (CDS) are a preferred derivative instrument to mitigate this risk.

**Operational risk** is innate to all companies in the oil sector. The hazardous nature of oil and oil products has to be constantly dealt with extreme caution. The major operational risks are: quality risk, storage risk, headline risk and legal risk.

**Regulatory risk** has increased since Bulgaria joined the European Union. The stricter regulations for diesel, gasoline, and gasoil have forced local traders to improve and maintain the quality of their products by investing in specialized equipment.

A considerable **market risk** in the near future can be natural gas. Because it is cheaper and cleaner than many oil products, gas can reduce the total market volume of oil products in the next years. Also, renewable energy sources are gaining ground in Bulgaria.

**Benchmark risk** can be considered to be low on the Bulgarian market. The two local benchmarks are almost perfectly correlated. But there are still fluctuations.

These can be described as the major risks that an oil trader can face on the Bulgarian local market. All of them can lead to an unfavourable price. There are many more, but they are

most of the time unpredictable and unquantifiable. It is important to note that different companies are exposed to the listed in this part risks in different ways. It is up to the management of a company to decide how to deal with them.

## 5.6 Risk Management with Derivatives

There is always the risk that a certain price will not be competitive enough on the market in a desired point in the future. This price risk can be reduced with the use of derivatives. Derivatives can be invaluable instruments for managing price risk, if they are used correctly. The four derivative products are futures, options, forwards and swaps. There are also many variations of these products, which are designed to meet individual market needs.

Derivatives can be used to hedge both the physical oil product and the local currency. The concept in both cases is the same. The manager will not make losses from an unfavourable price movement in the future. But he will also not make profits, if the price moves the right way. Only options allow for some potential benefits, but the premium that has to be paid upfront reduces the size of these profits.

There is a big difference between commodity derivatives and financial derivatives. Commodities like oil products can be physically traded, which means that a physical exchange of goods occurs. Crude oil tankers move the product from one point to another, where the customer receives the product, unloads it, and then can refine it to produce physical oil products. Financial derivatives trades, on the other hand, are settled by exchanges of cash flows.

### 5.6.1 Currency Risk

Currency risk can be managed in many ways by using derivative instruments. However, the best hedging strategy is closely related to the market of hedging. In Bulgaria, this can be done by using banks as an OTC partner or over an exchange. But by using currency futures, the local trader will first have to convert BGN to Euro and later repeat this procedure, but the other way around. Although the national currency is pegged to the Euro, banks will offer slightly higher rates than the official exchange rate of the Bulgarian National Bank. This will create certain costs and fees that will have to be carried by the local trader.

Instead, only OTC trading possibilities will be considered. As mentioned earlier, domestic banks are not very enthusiastic when it comes to derivatives. Also, little is known about the local OTC market, as companies would prefer to keep the details of an OTC deal confidential. As a result, options could have high premiums and forwards contracts may not satisfy completely a trader’s needs.

Swaps may have a potential on the market. There are several reasons for that. Firstly, swaps originated as a way of financial institutions to exchange one currency for another, which makes them suitable for this case. Secondly, because the times of delivery for oil products are known, a manager can be prepared for an exchange of currencies in advance. Finally, by using swaps, lower transaction costs could be achieved.

The following example will describe how swaps could be used in a simple way. If a trader is expecting a cargo of fuel in one week, he can prepare for the payment of this cargo in advance. The trader will have to pay for the cargo in USD. Instead, he could enter into a

swap deal with a bank. Supposed, the bank needs BGN and has some USD in excess. The trader can raise BGN and then swap the quantity of BGN for the corresponding amount of USD. The bank receives the BGN it needs, and the trader receives the USD to pay for the cargo of fuel.

In real life, such examples could be found rarely. The OTC market is very illiquid and it may take a long time until the matching counterparty is found. Also, by hedging the local currency and the oil product, the cost-of-carry of this hedging strategy will be big. Some traders may not be willing to carry these costs. In addition, there is more room for error when hedging two different markets simultaneously.

### 5.6.2 Price Risk

There many derivative instruments that can be used to manage price risk. All of them can be applied on the Bulgarian local market. But each of these derivative products has certain advantages and disadvantages. These can be seen in Table 18.

**Table 18 Pros and contras different derivative instruments**

| Hedge | Pros | Contras |
|---|---|---|
| **Commodity Futures** | Liquid | Standardized terms |
| | Low transaction costs | Potential for unlimited losses |
| | Can be rolled over | No benefit from favourable price movements |
| **Commodity Options** | Benefit from favourable price movements | Expensive |
| **Commodity Forwards** | Terms can be customized | Illiquid |
| | Low risk | High transaction costs |
| | No immediate cash flows | No benefit from favourable price movements |
| **Commodity Swaps** | Customized Terms | Expensive |
| | Useful for recurrent cash flows | No benefit from favourable price movements |

First of all, there are two ways to manage price risk for oil products. One of them is by using the paper market. The other is by using both the paper and the physical market.

**Futures** can be used almost by anyone and anywhere. The trader needs a registered broker, who serves as a mediator between him and the exchange. The process of buying or selling futures contracts is quite simple. The communication between trader and broker can be done in many ways: phone calls, emails, fax, and text messages. It usually does not take long for a futures contract trade to be initiated as the market is very liquid. Not to forget, a marginal account has to be opened and a deposit has to be placed. There is also the possibility to specify prices, which are beyond the current bid/ask spread. If the futures market is in backwardation, the trader may want to buy gasoil futures at a price, for example, at the current quotation minus $5.

But risk can be transferred in many ways. A local trader may let others do the hedging instead of him. There are some trading and risk management companies that have already

entered the Bulgarian market. But by letting others do the hedging, the trader will usually have to pay more for this service than he has to, when hedging himself.

**Options** are more expensive than futures. This makes them quite undesirable. Especially as the local market is rather illiquid, upfront premium payments and extra hedging expenses are not welcomed by many traders. But some exotic OTC options can provide the required trading safety. It all depends on the type of the cargo, the times of buying/selling, and the current trading environment.

**Swaps** can be used for physical products that do not have a futures equivalent on a commodity exchange. These can be jet or fuel oil on the Bulgarian market. In the past years, some exchanges have begun offering clearing services, in order to stimulate the trading environment of these products. But jet and fuel oil must be traded OTC. And like all OTC trades, finding the matching counterparty can be a problem.

There are also some derivative variations that can be used to manage price risk successfully, like CFDs (Contract for Difference). CFDs are actually swaps, which are settled by exchange of cash flows. They allow two counterparties to bet on the price of a certain product in the future. As this price fluctuates, the difference has to be paid by the counterparty that had bet on the wrong price movement. Therefore, cash flows have to be exchanged on a regular basis (daily, weekly, monthly) or at the end of the specified period. It all depends on the contract, which the two counterparties have signed.

**Forwards** can be the right instrument to hedge physical oil products on the local market. Forwards are like futures contracts, but they lead to a physical delivery of the product. This is why they are perfectly suited for hedging imports of oil products. Forwards are OTC trades that can be illiquid, but there are companies and individuals that can be the perfect match for the local trader. After all, there are several possibilities in Bulgaria for loading and unloading of shipments of oil products. Some of the international oil flows can be diverted to the Black sea. Also, the Danube River offers the possibility to transport barges of oil products.

Not to forget, forwards can be combined with other derivative products. In this way certain risks can be reduced, but for an extra charge. Also, a manager can use other risk management techniques. For example, a local trader may diversify his strategy by purchasing products from several sources. Long-term contracts can be signed to guarantee a company's market position and share. Insurance contracts can be used to negate eventual transportation or storage risks.

Price risk quantification is always difficult. There are many factors that influence the price of an oil product. This means that only estimations can be made. When the Bulgarian local market is concerned, price risk is closely related to the local benchmark – Lukoil. This is why the listed prices of this company can be used as reference to predict future price movements. As seen in the previous part of the thesis, Lukoil is changing its price only several times a month. Also, Lukoil prices are closely related with the other benchmark, which is used on the local market – Platt's.

As a result, simple quantification models can be used, like VAR. Supposed, Lukoil is going to change the listed prices for a certain oil product only 5 times a month. Platt's assessments will remain relative stable, only with small fluctuations. This means that the value of risk can

be estimated. Because Lukoil can either increase, or decrease the price of a product, a two-sided VAR can be developed.

If a trader is planning to import a cargo of a certain oil product, he has to consider the situation, when the product is unloaded. Some shipments require a time period of two to three weeks, sometimes even a month. If Lukoil is expected to change the price by 60 BGN, then there is a chance that the trader can gain or lose from this change. A VAR report may sound in this case as: “Lukoil may change the price 5 times a month, resulting in a gain or loss of 60 BGN per 1,000litres.” Also, as Lukoil prices are in BGN/1,000 litres and Platt’s assessments are in $/mt, the density of the product at 15 degrees Celsius must be taken into consideration.

## 5.7 Forwards Example as a Sale and Purchase Contract

When hedging physical oil products, one of the important parameters of the contract is the location for unloading. As it can be seen from Figure 29, there are two major ports in Bulgaria on the Black Sea and several small on the Danube.


Figure 29 Ports for loading and unloading of physical oil products[138]

[138] Google Maps, “bulgaria map,” http://maps.google.com/maps?rls=com.microsoft:en-gb:IE Address&oe=&q=bulgaria+map&um=1&ie=UTF8&hq=&hnear=0x40a8fec1c85bf089:0xa01269bf4c10,Bulgaria&ei=u7U_T6b0M8qOswaQp8jfBA&sa=X&oi=geocode_result&ct=image&resnum=1&ved=0CCwQ8gEwAA, accessed February 2012.

Varna and Burgas are relatively big ports. This allows for the docking of large tanker ships. The port in Varna has recently been expanded, and has room for ships of up to 50kt. The Rosenets oil terminal of Lukoil in Burgas can accommodate ship cargoes of 100kt. Cargo sizes determine the price. The bigger the cargo, the lower the price will be. For example, 20kt of gasoil can be purchased at a price of Platt's + $30. Cargo sizes of 2kt can be priced at Platt's + $50. This means that the bigger the purchased product quantity is, the bigger the profit margin of a trader will be.

The small ports on the Danube, like Ruse, allow only for small cargos to be unloaded. Barges and small ships can, therefore, carry cargoes of about 2kt. This depends pretty much on the current level of the river. If the level is low, the maximum possible cargo size will be reduced.

It is important to note that port taxes can vary according to the client or the owner of the port. This leaves some room for price uncertainty. If the taxes are increased prior the unloading of a product, the importer will have to deal with higher costs. Also, the transportation of the product to the storage facility of the trader can pose potential threats. Most of all, it is the form of transport that is important for the final price of the product. Transport by sea is considerably cheaper when compared with transport by land, like by truck or by a railroad composition.

**Example**

Forwards are OTC sale and purchase contracts between two parties. One of the parties obliges to buy a certain product, and the other declares to sell this product. The most important parameters of this contract are the type of the product, quantity, date of delivery, port for delivery and price per unit. In this example, the following parameters will remain constant:

- the product will be **Diesel 10 ppm**
- size of the cargo will be **3,000 mt**
- date of delivery will be the 15$^{th}$ of February
- current date is the 1$^{st}$ of February
- delivery port will be Varna
- port of origin will be Reni, Ukraine (see Figure 29)

These are some of the parameters specified in a sale and purchase contract. But the most important parameter is the price of the specified product. Because the delivery is expected in two weeks, derivative instruments can be used to form a hedging strategy. There are many ways to hedge by using only one derivative, or a combination of several derivative instruments. This example will offer a combination of options, futures and forwards. But first, the principal clauses in a sales and purchase contract will be discussed.[139]

1. Detail of the **parties**, with clear descriptions of seller and buyer like name, address, company details.

2. Type of **product** and **origin** of this product. In this example it is Diesel 10 ppm from a Non-European origin. Because of the origin, further customs documents will have to be filled.

[139] Salvatore Carollo, *Understanding oil prices: A guide to what drives the price of oil in today's markets* (Chichester: Wiley, 2011), pp. 90–94.

3. **Quality**, a detailed description of the product name and a corresponding EU-standard.

4. **Quantity**, the exact definition of the size of the cargo. Normally, this can vary, for example, 3,000 metric tonnes +/- 10%.

5. **Delivery**. This clause specifies the conditions and manner with which the seller delivers the product to the purchaser. The two most common ways are:

- **FOB** (Free on Board): the buyer receives the specified product at the port of origin, with his own vessel. The port, in this case, is Reni.
- **CIF** (Cost, Insurance and Freight): the seller of the product arranges for the transport of the cargo to the delivery port (Varna). Also, the seller insures the value of the cargo against risks of contamination or risks of loss and damage to the product.

This is the reason why CIF prices are always higher than FOB prices. The party, which is taking the risks of transportation, receives a premium.

6. **Price**. In this clause is the formula for calculating the price of the cargo. It must contain the reference benchmark and premium for the specific product. In this example, it will be Platt's + $40. In this clause, also parameters like escalation/de-escalation can be discussed. As the product is offered with a specific density, if the density at discharge is different, this difference will have to be posted post collateral by the side, which profits from this difference.

Diesel is usually specified with a density of 0.845 g/$m^3$ at 15℃. If the density is 0.83 g/$m^3$ at discharge, the seller will have to pay the difference in cash to the buyer. This is why independent specialized laboratories are chosen to measure the exact density of the product.

There is also one more problem. The contract is for diesel 10 ppm, but there are no diesel futures. Therefore, another product has to be chosen as reference. This can be gasoil, as it is very similar to diesel and the prices for both of these products have a good correlation coefficient. In practice, the differential between Platt's FOB Med High "10ppm ULSD" (Ultra Low Sulphur Diesel) quotation and the settlement level of the ICE Gasoil Futures Front-month is used to relate the price of diesel.

7. **Options**. But, since derivative products can be combined, OTC options can also be part of this contract. Because OTC options can be customized to meet the client's needs, many possible scenarios can be forged.

Trigger options could be used as an example. They enable the buyer of the product to trigger certain parts of the whole quantity, during the time the ship is travelling from Reni to Varna. This right, of course, means that the buyer will have to pay a premium to the seller, as he can choose favourable prices, according to a specified benchmark. This can be the ICE Gasoil futures. So, the buyer can close lots, according to the current quotations of ICE Gasoil.

As there can be considerable fluctuations, and the price of gasoil can fall dramatically in a certain day, the size of the triggered quantities is limited. If the whole cargo is 3,000 mt, the buyer may be allowed to trigger only 400 to 500 mt per day. But the buyer will have to trigger the whole 3,000 mt in a period of two weeks. Furthermore, the buyer may be obliged to pay a marginal deposit to cover eventual losses of the seller.

8. **Payment**. Payments are in US-Dollars, and the buyer will have a specified deadline to pay his obligations to the seller. The buyer will also have to open Letters of Credit or a bank guarantee in favour of the seller, in order to reduce the counterparty risk of the seller.

9. **Demurrage**. This clause specifies the event, if a ship is delayed or the unloading takes too long. The seller will have to compensate the buyer for eventual delays.

10. **Force Majeure**. This clause defines the list of all the exceptional events, which can be considered sufficient to suspend the obligations of the contracting parties. For example, these can be a breakdown of the ship or impossibility of loading.

There are also other clauses, which regulate other issues. But as it can be seen, this forward contract can reduce the price risk for both parties. The seller can also enter other derivative trades, to ensure that he will not suffer an unfavourable price at the time quantities are triggered. Usually, swaps offer many possibilities to transfer or take risk.

The buyer, on the other hand, has been hedged by the seller via the trigger options and the forward contract. But these exotic options can be hard to handle. The ICE Gasoil Futures are very volatile. There can be days, when the price fluctuates by $20 to $30. If the buyer waits too long for a better price, he can miss his chance very quickly. This is why triggering lots of gasoil on an average price can be a good idea.

To summarize the details from the sale and purchase contract, the price is Platt's +$40 with an ICE trigger option and the delivery is CIF Varna. If a lot is triggered at an ICE Gasoil Futures level of $1,000/mt, the market differential is $20/mt and the measured density is 0.8335, the invoice for this lot will be:

- ICE Gasoil $1,000/mt
- Premium + $40/mt
- Market Differential + $20/mt
- Total $1,060.mt
- Density Escalation = $\frac{0.8450}{0.8335} \times \frac{\$1{,}060}{\text{mt}}$ = $1,074.63/mt
- Trigger Amount $107,463 for 100 mt

By triggering lots of gasoil, while the cargo is on the water, the buyer is hedging himself. Thus, he is reducing the price risk exposure. The trigger option allows the buyer to benefit from favourable price movements, but the cost of this insurance is an upfront premium. This premium can be combined with the profit margin of the seller to form one single premium. The rest of the quantity can be triggered in the same way. The end result will be a final price, which will be close to the average price of this period of two weeks. This final price will also be on a competitive local level, as it will be below Lukoil's daily quotations.

Nevertheless, a sale and purchase contract can have many other clauses and can offer other hedging possibilities. Because this is a physical OTC trade, this contract can be modified to meet the requirements of both seller and buyer. The compromise between these both parties, should allow both of them to reduce their price risk exposure.

# 6. Recommendations

It is up to the manager or the trader to decide how to react to risk exposure. Risk can be taken, transferred or reshaped. Taking risk is speculation. Over the long run, this can lead to substantial losses. Transferring risk is done in ways of insurance contracts or options. But these require an upfront payment. If the feared event does not happen, the premium will be lost.

Reshaping risk is hedging. By shifting the risk from the physical market to the financial market, the manager can use the paper market to offset possible future losses. But it is very important to construct the hedge correctly. If both positions lose, this will injure severely the financial side of the company. To repeat again, derivatives are “weapons of mass destruction”. One bad decision can have dire consequences.

This is why simple hedging strategies can be profitable on the long run. If the manager can lock a certain price or a profit margin by using derivative instruments, he can concentrate on the core business of the company. This will allow him to gain an edge over the market competitors.

Also, it is important to differentiate between short and long-term hedging strategies. Short-term strategies can be perfect for hedging physical product supplies. Because the time frame is small, the room for risk is not great. However, by increasing the timeframe, many hidden risks or sudden unpredicted events can pose threat to the company’s portfolio. This is why long-term hedging strategies can be dangerous, if the market changes unfavourably.

**Variables**

A manager, faced with the problem to hedge, can choose between a wide variety of derivative products and the way to deal with them. These variables are:

- product to be hedged
- derivative instrument
- buy or sell
- write or buy an option
- size and number of contracts
- exercise price
- time point in the future
- expiry date

The number of combinations is immense. To construct the right hedge, historical market data and market experience can be of great use.

**Recommendations**

The oil market consists of many financial and physical layers. What they all have in common is that they are all exposed to certain price risks. The recommendations for the major participants on the oil market can be seen in Table 19.

**Table 19 Price risks for major market participants with recommendations**

| Market Participant | Price Risks | Recommendations |
|---|---|---|
| Oil Producers | Low crude oil price | Sell crude oil future or buy put option |
| Petroleum Refiners | High crude oil price | Buy crude oil future or call option |
| | Low product price | Sell product future or swap contract buy put option |
| | Thin profit margin | buy crack spread |
| Storage operators | High purchase price or low sale price | Buy or sell spread contracts |
| Airlines and transport companies | High fuel price | Buy swap contract or futures and call options |

Traders are intermediaries between these four groups of market participants. They need to adapt their strategies according to the market they are operating. This is why they face a high price risk exposure. But the risks they are taking determine their profits.

Local traders are dependent on the large energy companies in the country. Because their business can sometimes be constructed on a thin profit margin, hedging this margin can be vital, if they want to remain competitive on the market. As seen from the previous chapter of the thesis, forwards can be used to mitigate the price risk for oil product imports. But these OTC contracts also lead to the introduction of new market participants to the local market. This may, in time, increase the liquidity of the local market.

But till then, local traders can use derivatives to hedge their supply chain. The OTC market in Bulgaria is rather illiquid and trading partners must be sought for abroad. Futures can always be used as a benchmark to measure the price level of a company's own oil products. Options are not welcomed by many traders, because they are expensive and their use can be complicated for some. Options pricing is rather complicated and knowing the right time to exercise the option can be a problem. Swaps can be used to manage currency risk, with local banks serving as the matching counterparty.

**Fuel Oil Swaps**

Because Lukoil is not offering fuel oil since 2012 on its official website, there can be a profitable market for this product. This is why an example of how to use fuel oil swaps will be shown. Firstly, this trade has to be done OTC. But the ICE and other clearing houses are offering clearing services for fuel oil 1.0%S. There are also international companies that deal with risk management of oil products, fuel oil included. This means that there can be a rather liquid financial market for this product.

This example will be based on the Platt's quotations for 22.07.2011. The product is Fuel Oil 1.0%S and the price is $704.24 by choosing the FOB Med High quotation. The Platt's assessment is exactly at 16:30 London time. This offers a good opportunity for fast price benchmarking with gasoil on ICE.

Supposed, a trader is going to import a barge of fuel oil 1.0%S. The port of delivery is situated on the Danube River. Because the level of the river is low, the maximum cargo size is only 1kt. But the minimum contract size of the clearing house is 5kt. This means that the trader will have to import several barges or find a trading partner and hedge OTC.

If the trading partner is willing to enter in a trade, a swap contract can be signed. But as the trader is importing physical products, he will need to take the opposite position, namely sell. So, the trader is short 1,000 mt fuel oil 1.0%S in the paper market. This also means that this trade will be cash settled. The counterparties will exchange cash flows to compensate unfavourable price movements.

If the trader is buying the physical product on a Platt's + $40, he will need to pay ($704.24+$40)/t = $744.24 per tonne. To lock this price, he needs to sell at the same price.

**Buy Physical**: 1kt FO 1.0%S at $744.24/t July

**Sell Paper**: $744.24 Short FO 1% FOB Med Swap August

Supposed, the trader is planning to sell the whole quantity in four weeks, with an average quantity per week of 250 tonnes. The following table will provide hypothetical values of the swap process.

**Table 20 Hypothetical swap values**

| Week | Sell<br>t | Price<br>USD/t | Total<br>USD | Cash flow<br>USD |
|---|---|---|---|---|
| 1 | 250 | 744.24 | 186,060.00 | 0.00 |
| 2 | 250 | 750.25 | 187,562.50 | -1,502.50 |
| 3 | 250 | 760.55 | 190,137.50 | -4,077.50 |
| 4 | 250 | 730.75 | 182,687.50 | 3,372.50 |
| Total | 1000 | | 746,447.50 | -2,207.50 |

Because the price fluctuates, the trader will face losses in week two and three. Although the price becomes more favourable in week four, the trader will make a combined loss of $2,207.50 on the paper market. But he will gain on the physical market, as the prices have increased.

In this case, currency risk could also be considered by the trader. He could enter a second swap trade with a local bank to hedge his currency risk exposure. Or he could decide to remain un-hedged.

Currency risk should always be considered, when big quantities of one currency are going to be exchanged for another one in a certain point in the future. The hedging techniques are the same as by oil products. There are only other benchmarks and other markets.

# 7. Conclusion

The oil market comprises of many different layers. There is the physical market, which is divided into the crude oil market and the market for finished oil product. But there is also the financial market. This combination allows for both experts and newcomers to explore the various depths of the world of oil, regardless of their background.

Many things have changed, since the introduction of crude oil futures and other derivative instruments. Nowadays, anyone is able to buy or sell paper contracts, without having the intention of taking physical delivery. In this way, companies and managers could hedge their price risk exposure. By taking short or long positions in the future, traders could reduce the possibility of unfavourable price movements in the future. Also, more complicated hedging strategies could be forged, to consider many other risks, like currency risk.

But when there are hedgers, there are always speculators. Many big and small financial institutions seek in the financial oil market a way to make profit. Sometimes they could win from favourable price movements, but this is not always the case. There are many examples from the recent past, when major companies went default or were bought off after their derivatives strategy went wrong.

Speculators have been responsible for major oil price disturbances and market squeezes. When trying to achieve win-win scenarios, they can easily hurt the fragile balance of the oil market. However, speculators play a vital role in providing liquidity to the market. If there was no one to bet on all possible price movements in the future, hedgers could find the matching counterparty for a trade with difficulty.

The major players on the oil market are the producing nations, the big oil companies, and the financial institutions. The producing nations are the ones that provide the raw material for all of the fuel types, except bio-fuels. The major oil companies have both upstream and downstream integrated productions, which makes them rather independent. Nevertheless, non-oil companies have began to make ground in the energy sector in recent years. With renewable energies becoming an even more substantial energy source in the next decades, their role will increase dramatically.

Financial institutions could be blamed for the constant increase of oil prices till 2008. But everyone was taken by surprise, when these prices fell dramatically with over $100 per barrel in just a couple of months. Because petroleum is a non-renewable energy source and there are limited reserves of this product around the world, its price should increase constantly. Also, further oil fields will have to be developed in the future to meet the global oil demand. Nevertheless, these fields will be more cost intensive to operate, like deepwater rigs. This is why betting on rising oil prices can be a wise decision. But because a lot of people around the world think this way, making a profit out of this belief can be quite risky.

Among all financial institutions, hedge funds are the ones that can have a severe impact on oil prices. With their absolute return strategy, hedge funds can profit whether prices go up or down. Many issues about regulating these institutions have been raised in recent years and some changes have been made. But hedge funds, with the help of some banks, contribute to the volatility of oil prices. Of course, there are many other predictable and unpredictable factors. Some can be measured and quantified, other not. But the truth is that oil prices are out of control and no one is able to predict the precise oil price in a certain time in the future.

This is why price risk is the major issue that concerns all of the oil market participants. There are several ways to reduce price risk. This can be done by using derivatives to hedge, buying insurance contracts, diversification of the portfolio, or entering long-term contracts. Also, combinations of these ways can be used to achieve a higher risk tolerance. But it is up to the management of the company to decide whether certain risks should be reshaped or left to chance.

Derivative instruments like futures, options, forwards, and swaps offer various possibilities to manage price risk. This can be done by taking long or short positions in the future. Also, combinations of different positions can be applied. But the more complicated a hedge becomes, the more room there is for error. A good hedging strategy can cover several risk exposures. But factors like the cost-of-carry of a hedge could reduce the profitability or even lead to a loss, if not managed correctly. Derivatives can also cause severe damage to a company, if the physical market and the market to be hedged both fail to make a profit. This can happen if the chosen products are not closely correlated or the manager is applying a rather speculative strategy. To quote Warren Buffet again: “derivatives are weapons of mass destruction”. One wrong decision can be fatal.

The oil market consists also of numerous small local markets. These markets can differ in many ways. One of the most important parameter is liquidity. If the local market is illiquid, OTC trades could be done with difficulty. Another factor is the local currency. If it differs from the currency of import, currency risk can lead to substantial losses.

Lukoil and the Bulgarian local market are an example of a rather illiquid market with only one refinery inside the borders of the country. These facts leave plenty of room for speculation. But, as seen from the comparison between the local benchmarks Lukoil and Platt’s, there are certain price movement patters. These patterns could allow local traders to lock a desired price or a profit margin by using derivatives.

However, the profit margin can be sometimes very thin. This makes some derivative products undesirable. Because the price risk on the Bulgarian local market is closely related to the local benchmark, the physical imports of oil products are the ones that need to be hedged. Here, forwards contracts provide the right tool to manage this price risk. Also, forwards can be used in combination with exotic options to offer a trader more flexibility.

Currency risk is also an issue for all imported products in Bulgaria. The exchange rate for USD/BGN is very volatile and leaves plenty of room for unfavourable price effects. In this case, swaps contracts can be the appropriate tool and the local bank can be the right OTC partner. But seizing the right moment to make a swap trade can be problematic, as the local market is illiquid and banks are careful when entering derivatives deals.

To conclude, price risk a major source for potential losses. It is the sum of many other small and big risks. Some can be predicted, quantified and managed, others not. When oil and oil products are concerned, the innate volatility of the market can cause severe damage to a company. As the oil market is a global network, the events that influence the price of oil on a daily basis also have an effect on local markets. This is mainly due to the global and local benchmarks, which are highly correlated. This is why understanding what is causing oil price disturbances and managing them with the right instrument can allow a company to gain an edge over its competitors.

## Glossary

**Arbitrage** – the simultaneous purchase of a commodity/derivative in one market and the sale of the same (or similar) in another market in order to exploit price differentials.

**API** – American Petroleum Institute. API gravity is the usual standard for measuring the density of petroleum.

**Backwardation** - when the market participants expect the price to go down. The forward curve is decreasing with maturity.

**Barrel (bbl)** – standard measure of quantity for crude oil, equals to 42 US gallons or 159 litres.

**Barge** – vessel carrying oil or oil products, usually on rivers, weighing 1000 to 10000 tonnes.

**Benchmark** – a reference parameter to a price, portfolio, index used in means of measurement.

**BGN –** Bulgarian Lev, the national currency in Bulgaria

**Bid/ ask** – a measure of market liquidity. The bid is the price level at which buyers are willing to buy. The ask is the price level at which sellers are willing to sell. The thinner the spread - the higher the liquidity

**Blending** – a mixture of different products or grades in order to obtain a desired outcome.

**Bloomberg** – a financial and data service

**Bond** – a certificate issued by a borrower as receipt for a loan longer than 12 months, indicating a rate of interest and date of repayment.

**BP** – British Petroleum, one of the major oil companies.

**Brent** – the most commonly traded North Sea cure oil and a global crude benchmark.

**BRIC** – it is an acronym for Brazil, Russia, India, and China

**CFD** – Contract for Difference, a derivative variation of swaps

**CIF** – cost, insurance and freight charges for shipping products

**C+F** – cost and freight

**Clearing** – the process of matching trades, settling trades and provision of a guarantee for traded contracts, often a service performed by exchanges under the form of clearing houses.

**Contango –** when the market participants expect the price to go up. The forward curve is increasing with maturity.

**Cost of Carry** – the cost of holding a position, often in the form of dividends paid, interest or opportunity cost.

**Crack spread** – a calculation of the worth of a barrel of crude in terms of the value of its refined products.

**Cracking** – a technological process used in refineries to break heavier molecules of hydrocarbons into lighter ones.

**Crude oil** – is the unrefined physical product. It is a complex mixture of hydrocarbons and other organic compounds.

**Delta** – option premium

**Demurrage** – the detention or delay of a vessel in loading or unloading beyond the time agreed upon.

**Derivative** – a financial instrument whose value derives from the change in price or other financial characteristics of some other, underlying asset or instrument.

**Diesel** – a distillate fuel used in diesel engines

**Distillation –** a separation process that results in separated products with different boiling points.

**Downstream** – a term in the oil sector used to refer to the refining and selling of products.

**EIA** – Energy Information Agency of the United States of America

**EU** – European Union

**EURIBOR** – interbank lending rate for the euro, see LIBOR

**Factoring** – buying trade debts in order to assist cash flow.

**FOB** – stands for Free on Board. FOB prices exclude all insurance and freight charges.

**Foreign Exchange (FX) –** the rate or price for which one currency is exchanged for another.

**Forward contract** – a contract to buy or sell a commodity or security for future delivery at a price agreed today.

**Futures contract** – an agreement to make or take delivery of a commodity at a fixed date in the future, at a price agreed upon at the time of dealing. Futures contracts are usually not expected to go to delivery as the position will be closed or rolled prior to that.

**Gasoil** – an intermediate distillate product used for diesel fuel, heating fuel and sometimes as feedstock. In the USA it is called No. 2 Heating Oil.

**Gasoline** – volatile motor fuel used in cars.

**Gearing** – carrying out financial operations on the basis of a deposit or borrowed money. It is also called leverage.

**Hedge fund** – an actively managed fund that seeks an absolute return, that is, a profit whether markets go up or down.

**Hedging** – a technique for limiting risk. If a price movement would cause a loss, a purchase is made for options or futures contracts giving the opposite result. In other words hedging is the coverage of price risk.

**Ibid**. – short for ibidem and it means the same place

**ICE –** Intercontinental Exchange, one of the major exchange markets for physical oil products. The traded energy futures are Brent, WTI, gasoil, natural gas, coal, emissions.

**IMF** – International Monetary Fund

**Inflation –** a sustained increase in the general level of prices for goods and services

**KPMG** – a large professional services network

**Kt** – abbreviation for one thousand tonnes

**Leverage** – see gearing

**LIBOR –** London Interbank Offered Rate, charged by one bank to another for lending money.

**Long** – to be "long" is to own more than it has been sold.

**LPG** – Liquefied Petroleum Gas

**Margin –** the deposit required by a clearing house. It can also be referred to as a profit.

**Mark to market** – valuing securities or derivatives at the current market price.

**Maturity** – validity of a contract or the time specified for delivery of an underlying

**Mt** – an abbreviation for metric tonne, one metric tonne is equal to 1,000 kilograms. It is used to measure the quantity of oil products. Another unit is 1,000 litres.

**NSI** – National Statistical Institute in Bulgaria

**NYMEX** – New York Mercantile Exchange which is one of the biggest commodity markets.

**OECD** – Organisation for Economic Co-operation and Development. Members are Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

**OPEC** – Organisation of the Petroleum Exporting Countries

**Options** – the right, but not the obligation, to buy/sell commodities or contracts in the future at a price agreed upon today. Options can also be traded.

**OTC (Over the Counter)** – refers to deals made outside of an exchange.

**Paper contract (financial contract**) – is a contract settled by a transfer of cash. It is used by a trader or investor who doesn't want to take delivery of a commodity but still wants to manage his price exposure.

**Physical contract** – is a contract which is settled by a physical transfer of a commodity form one owner to another.

**Platt's –** a provider of energy and metals information and a source of benchmark price assessment in the physical energy markets.

**Portfolio** – a financial term denoting a collection of investments held by a company, institution, fund or individual.

**ppm** – parts per million, 1 ppm is equal to 0.0001%

**PWC** – PricewaterhouseCoopers, a global professional services team

**Residue** – the bottoms from a crude oil distillation unit

**Revolving credit** – is a commitment to lend on a recurring basis on predefined terms.

**To roll over** – the transfer of a position from one futures period to another involving the purchase (sale) of the nearby month and simultaneous sale (purchase) of a further-forward month. This technique is used to eliminate physical delivery.

**Settlement** – a process where commodities or securities are delivered against payment of money or fulfilment of obligations.

**Short** – traders are said to be short when they have contracted to sell more than they contracted to buy.

**Spot market** – the physical cash market in the energy sector for immediate delivery.

**Spread** – the difference between two prices

**Strike price** – the price at which an option allows the underlying to be purchased or sold. It is also known as exercise price.

**SWAP** – a derivative contract in which one counterparty exchanges cash or commodity with another.

**Swaption** – an option to have a swap in a certain time in the future.

**SWIFT** – Society of the World Wide Interbank Financial Telecommunication.

**UAE** – United Arab Emirates, one of the OPEC members

**Upstream** – a term in the oil sector to refer to the searching, exploration and production of oil.

**US** – stands for United States

**USA** – United States of America

**USD** – United States Dollars

**UK** – United Kingdom

**Value at risk (VAR)** – is an analysis to evaluate the risk of a position.

**VAT** – Value added tax

**Volatility** – a measure of the variation of market factors. It is defined mathematically as the annualized standard deviation of the natural log of the ratio of two successive prices. In historical terms it is the degree to which a particular price has fluctuated in the past.

**WTI (West Texas Intermediate)** – US crude oil used as a global benchmark for crude oil pricing and is traded on the NYMEX.

**Yield (financial)** – is the annual percentage return of a bond.

**Yield** – either the percent of a certain product or all the products from a process, which involves chemical changes to the feed

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