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# Trading Oil Futures

## Abstract

Oil is an important energy source and a necessary industrial raw material. Every country's economic growth and the daily life of its people are dependent on this energy form.

Historically, the oil prices have varied significantly on the world market. This led to at least two oil crises when prices increased in a very fast pace. In order to reduce such rapid fluctuations, oil was introduced at so called commodity exchanges. At such trading places oil could be traded openly for future delivery and hence the market was aware of price changes in advance. A commodity exchange sells special contracts in the form of so called "futures". In fact there are many different contracts, each exchange has its own set of them covering for a number of different oil types. This thesis deals with these contracts and how they are traded.

**Key words:** Commodity, Trading, Crude oil, Futures

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# Introduction

People have been traded as long as humanity existed. At the beginning, people exchanged things with each other. For instance, resident A gives a goat to B; then resident B gives two bags of wheat to A instead. Thereafter, one trade is finished. This kind of trade is called barter. In brief, barter is to the exchange of a service or good for another service or good. However, this type of trade can not always be achieved. Here are two crucial difficulties. First of all, it is not easy to find one who holds something you want and also be willing to accept things you offer. Like in the above case, if B likes to have cattle rather than goats, then the deal can not be made. Secondly, even if both sides hold the thing the other one wants, if they are valuing things so much differently, there is no way to make this trade. Given that B lives in a place which is abundant in goats, he/she may regard the goat as less attractive and then only like to pay one bag of wheat for it. Conversely, A lives in a place where goat is rare, then he/she may think that it is worth more than 2 bags of wheat, requiring 3 or 4 bags. Due to their discrepancy in valuation, this trade becomes impossible. In order to solve those problems, so-called “Commodity Money” was invented.

Commodities are things used almost by everyone or majority people, such as salt, bean, gold, silver and so on. They are of uniform quality and produced in large quantities by different producers. For that they are widely accepted by society, they can be used as money. The appearance of commodity money increased the volume and the frequency of trade greatly. Thus trade became a significant part of our daily life. However, commodity money has its own disadvantages. It is too heavy to carry, inconvenient to store and hard to keep fresh. Therefore commodity money substituted by paper money, the one we use today. The purchase power of paper money is guaranteed by the national government. Without this guarantee, it is just a piece of paper and worthless. This transition makes trade much easier and more convenient.

Although commodities are not widely used as money anymore, for that they are basic staffs of daily life and raw materials of industries, they are traded in enormous amount all over the world every day. Generally speaking, there are two types of trade: spot trade and forward trade. Spot trade is referring to the trade which payment and goods delivery happen at instant. For example, when someone goes to the gas station purchasing 10 liter gasoline for its car, this kind of trade is called spot trade. The car owner pays for the gasoline and gets gasoline immediately. Forward trade is referring to the trade in which payment or goods delivery will be fulfilled in the future. For instance, someone makes an agreement with a flower seller to buy a bunch of tulips next month when tulips are blossoming. And he/she promise to pay them when delivering. Due to the payment and goods delivery can not be executed at instant, the buyer and seller will establish a contract to ensure that no party would default (fail to pay). Thus forward trades are usually achieved through contracts. There are two kinds of forward trading: trade happens in an exchange and Over-The-Counter market (OTC).<sup>1</sup> The former includes futures contract trade and option contract trade. And the latter consists of forward contract, swaps and different types of option trade. Those

contracts in forward trading can be called derivatives. A derivative is defined as “a financial instrument whose value depends on the values of other, more basic underlying variables.”<sup>1</sup> Usually the variable underlying derivatives are the prices of traded assets. To the details of those mentioned derivatives, we will discuss in later sections.

Crude oil is such a commodity which is traded actively both spot and forward. Especially its futures contracts, which are traded with the largest volume among all the commodity futures contracts traded in the world. This paper is trying to analyze the mechanism of crude oil futures and why it is so crucial to the world oil market as to the world. And also it illustrates how to make good use of crude oil futures.

The discussion is organized as follows. Section 1 examines the appearance and growth as well as the current situation of spot trading of world crude oil. Section 2 firstly introduces origin of future exchange and then examines the reasons why crude oil futures came out and finally examines the evolvement of oil futures contract. In the third section, the paper examines the fundamentals of crude oil futures contract as well as some trading terms. And the final section provides some cases illustrating futures trading process and strategies.

## **1. An overview of world oil trade**

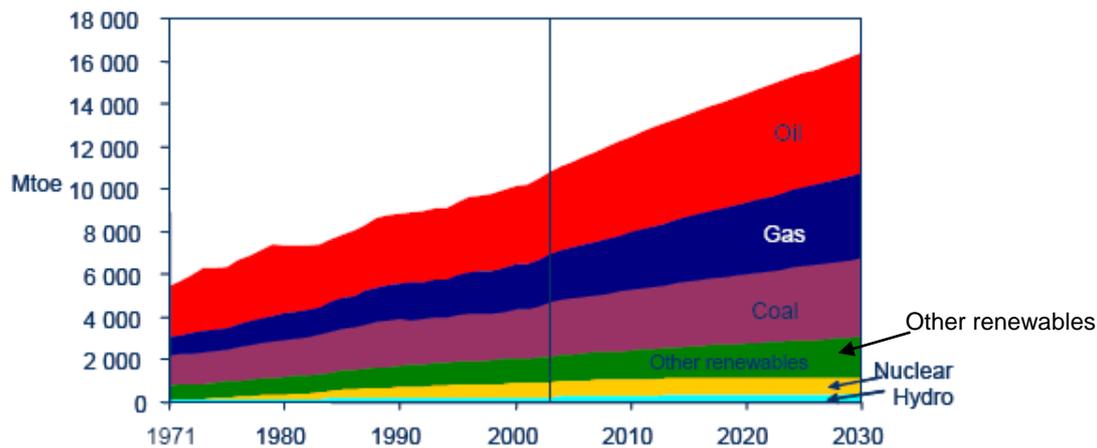
Oil is a part of what are called fossil fuels. Scientists believe that “it is formed by organisms—plants and animals—that died, decayed and were transformed into solid rock thousands or millions, of years ago as a result of high level heating.”<sup>2</sup> It is a composition of hydrocarbon molecules which has high net energy and is hard to replaceable, making that it is the dominant energy source fueling the world’s modern economy since when been explored. In history, there were thrice “oil crisis,” which caused great economic depressions in Western counties. Thus it makes oil the most political resource—the resource that make countries go to war—to maintain a country’s economy development hence stable the governance to the country. Meanwhile, it is also a commodity. “It is the single largest commodity in international trade and has been one of the most volatile.”<sup>3</sup>

### **1.1 The characteristics of oil<sup>4 5</sup>**

The base of modern economy is industry. And oil is crucial to modern industry. Among all fossil fuel, oil remains the single largest fuel (Graph 2.1). For a long run, oil is regarded as “black gold” or “the blood of industry” due to its various uses in industry. Generally speaking, the use of oil can be classified into two categories in industry. First is to be used as a fuel. Crude oil can be refined to gasoline, diesel, kerosene, heating oil, fire oil and lubricating oil and so on. To residents, these products can be used to warm houses, kitchen fuel or the fuel of their private cars; to industry or transportation, products like gasoline or diesel are the main power origin;

meanwhile, the fire oil is also the main fuel of various kinds of boilers. The second use of crude oil is to be used as the raw material of chemical industry. There are more than 5000 kinds of chemical products using crude oil as their basic raw material. Besides, the eight essential materials<sup>①</sup> of organic chemical industry are derived from crude oil. On agricultural, crude oil is also the main raw material of fertilizer (ammonia) production. Thus to some extent, oil means fertile fields.

Graph 1.1: World Primary Energy Demand

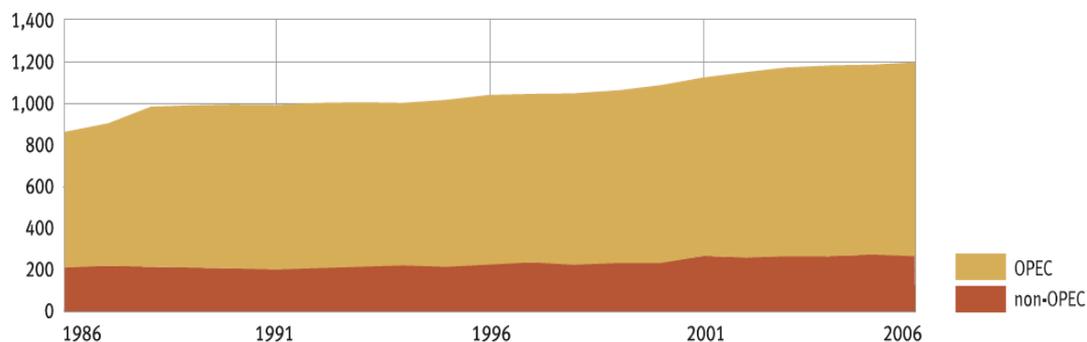


Source: IEA World Energy Outlook 2005 Middle East and North Africa Insights

\*Mtoe: Million Tons of Oil Equivalent

The distribution of oil is uneven. According to the OPEC's official published data, by the end of 2006, proved oil reserves stand at 1195.3 billion barrels<sup>②</sup>. Just the OPEC contributed 922.482 billion barrels, accounting for 77.2% of the total reserves. From the aspect of oil's location, approximately 62.2% is stored in Middle East. All the top five countries are centralized in Middle East, with the descending order, they are Saudi Arabia (264.25 billion barrels), Iran, Iraq, Kuwait and United Arab Emirates.

World proven crude oil reserves, 1986–2006 (bn b)



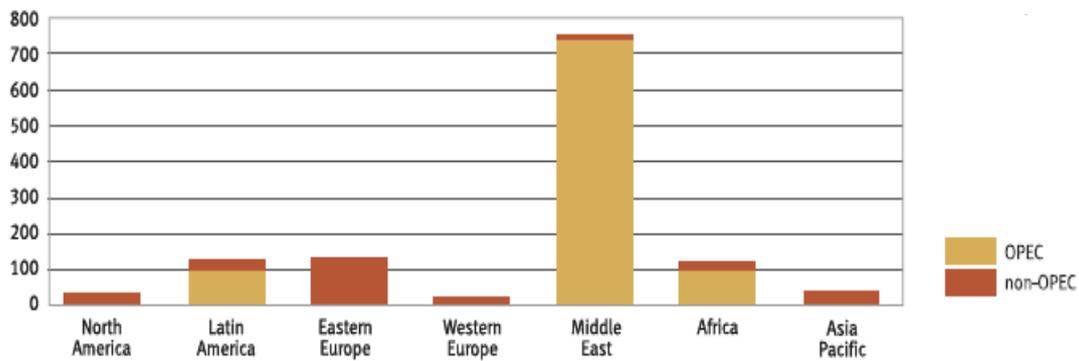
Graph 1.2: World proven crude oil reserves (billion barrels)

Source: The OPEC's Annual Statistical Bulletin 2006

<sup>①</sup> Ethylene, Propylene, Butadiene, Benzene, Toluene, Xylene, Acetylene and Naphthalene

<sup>②</sup> 1 barrel equals to 42 gallons

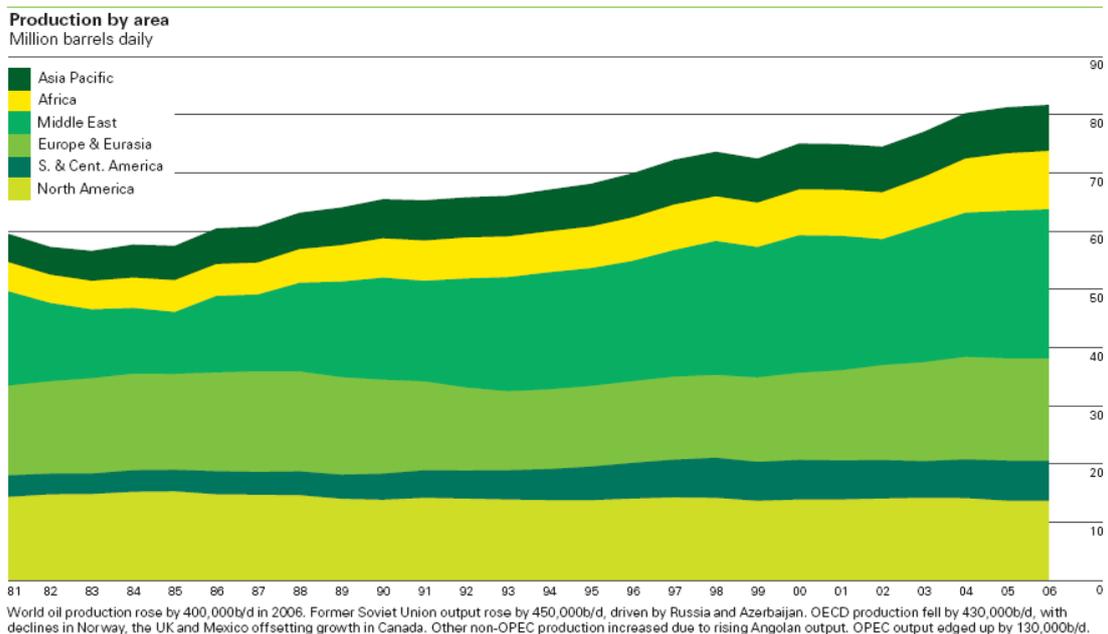
Crude oil reserves by region, 2006 (bn b)



Graph 1.3: Crude oil reserves by region, 2006 (billion barrels)

Source: The OPEC’s Annual Statistical Bulletin 2006

However, the consumption countries are not so centralized but scattered all over the world. By region, they are mainly located in Asia and Pacific, North America and Western Europe (Graph 2.4). According to the OPEC’s annual statistical bulletin 2006, the biggest oil consumption region is Asia and Pacific (22.679 million barrels), following with North America (22.219). And then it comes to Western Europe (14.368). These three consumed almost 75.7 % of the total consumption.<sup>6</sup>



Graph 1.4: Crude oil consumption by area, 2006

Source: BP’s Statistical Review of World Energy 2007

Comparing with the distribution and consumption situation, it is not hard to find this inconsistent phenomenon that the two regions with the least oil production consume most oil on Earth. Asia and North America consume 57.4% of the total

volume, but their outputs only occupy 5.5%<sup>①</sup> of the gross production. This contradiction makes oil trade around the wide world very necessary.

Meanwhile, oil is a nonrenewable natural resource. Unlike solar power or wind power, which can be used unboundedly, there is a limit in the use of oil. BP's Statistical Review of World Energy 2007 points that with the proved reserve and the pace of production, the oil on Earth can be used for only 40 years and natural gas for 60 years.

All these three characteristics make oil trade so crucial to most of the countries as well as the world.

## **1.2 The history of world's oil market<sup>7 8 9</sup>**

### **1.2.1 The oil market during 1945 to 1970**

In this period, the governments of oil producing areas did not involve in producing and pricing. They sold exploiting charters to international oil companies allowing those to exploit oil. At that time the exploiting and sale of oil was completely controlled by a few international oil companies. One typical example is the Standard Oil Company, which monopolized the whole United States' oil refining industry and market since kerosene (lighting oil) era. And it established the base of international oil industry by setting sub-corporations all over the world in the first decade of twenties' century. It was divided into several oil companies, including Exxon, Chevron, and Mobile and so on due to the antitrust charge by the USA's Supreme Court. After that, those mentioned three, combined with Gulf and Texaco in Texas, Royal Shell in Netherlands and BP in England, these seven companies are called "Seven Sisters" and forming the oligarchic monopoly market structure in world oil trade. Between 1960 and 1966 Seven Sisters' share of oil production outside North America and the Communist countries, had actually risen from 72 to 76 percent, leaving only 24 percent for all other companies.<sup>10</sup>

More and more companies were attracted by the extra profit gained by oil companies. Thus some smaller enterprises offered better conditions to the local governments in order to get the exploiting charter. The number of companies who held a charter rose from 33 in 1953 to 337 in 1969.<sup>11</sup> Due to this increase, the governments gained much more revenue; but the Seven Sisters market shares declined considerably. Meanwhile, because of the fierce competition, the oil price constantly decreased during 1960's.

Before 1950, the oil exporting countries income came mainly from selling the exploiting charters. And the price of the charter is counted on the output of oil. That means the more oil companies exploit, the more rent they should pay. After 1950's, the government required to share 50% of the companies' selling profit. For better calculating, the companies set an "assumption price", which was calculated

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<sup>①</sup> According to the OPEC's data: North America (26.957), Asia Pacific (39.017), Total World (1,195.318 million barrels). However, BP's Statistical Review of World Energy shows that North America has 59.9 million barrels.

considering all the companies' oil products selling price around the world (because selling price varied from place to place), and used it as the selling price to calculate profit. That is, the profit was equal to the assumption price minus cost. Due to oil price decreased constantly in 1960's, the oil companies had to reduce the assumption price again and again. This measure greatly shrank the governments' profit. Thus, in 1960, four Middle East countries: Iran, Iraq, Kuwait, Saudi Arabia, and one South America---Venezuela formed the Organization of Petroleum Exporting Countries (OPEC), in order to force the oil companies to raise oil price.

All in all, oil exploration and trade was monopolized by these international oil companies in this period. Thus crude oil was mainly traded through long-term contracts between companies or between companies and governments.

### **1.2.2 The oil price situation during 1970~1980**

These ten years is the decade which the oil price varies most greatly in history. During the decade, the oil price increased more than ten times. This change is mainly attributed to the two times "Oil Crisis".

Between 1970 and 1973, the USA's oil output reached to its peak. However, oil demand constantly increased in Japan and Europe. That caused world's oil demand from OPEC grew rapidly. Further more, it resulted in two changes in world oil market. First of all, the oil price almost doubled. The assumption price rose to \$3/barrel. Secondly, the growth in production volume and assumption price increased the income for oil-exporting countries greatly, thus they gradually began to strengthen their control in output.

In 1973, the first mid-east (between Israel and Arabic countries) war broke out. Because many developed countries including the USA had supported Israel in the Yom Kippur War or October War, which they fought against Egypt and Syria, Arabic countries shrank their export to those countries and started oil embargo to the USA. The elasticity of demand of oil was very low<sup>①</sup>, thus the shortage in supply caused a drastic increase in oil price on spot market. The OPEC used this opportunity increasing the assumption price (see page 9, line 1) to \$11.69/barrel in December, 1973<sup>②</sup>. This is the first time that the OPEC published an official price. Since then, the OPEC took place of the giant oil companies and began to control the production and price of oil. The OPEC's official price became the basis of world oil price and is published every OPEC's ministry meeting.

In the following four years, world oil market was comparatively steady-going. Until the famous strike in oil industry happened in 1978 in Iran, the oil price again began to sharply fluctuate. During this time, Iran's oil output decreased dramatically. For instance, in December 1978, Iran's oil exporting was completely stopped. This caused twofold shortage in supply compared that of 1973. Thus the oil price on market increased to \$35~\$40/ barrel. However, comparing to the spot market price,

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<sup>①</sup> Price elasticity of demand: Changes in the quantity demanded of a good divide the changes in its price. The elasticity is low means that when the price changes a lot, the demand only changes little.

<sup>②</sup> The price of Arab light oil (API 34), which has been used as a basis price for world oil pricing before 1985.

the official price was conservatively increased. In July 1979, although oil price on spot market rose to \$38/barrel, the highest OPEC's published official price is only \$23.5/barrel. This reflected the faith of OPEC's members to world oil market that the market would be stable very soon, and the market price would drop. Most of the OPEC members sell half of its production according to the official price, and the rest to market price.

The second break off in supply was happened two years later. In September 1980, Iraq attacked Iran, occupying its several oil fields. Thus a war broke out and lasted to 1988. During the war, both countries' oil output was greatly dropped. Then the oil price which had already down to \$33/barrel at the beginning of 1980 jumped back to \$38/barrel. Meanwhile, the OPEC increased its official price to \$32/ barrel.<sup>6</sup>

Nevertheless, the OPEC could not establish the new monopoly to the world oil market. One aspect, because of the booming of oil prices, the developed countries started to search for some substitute energy resource and make energy saving polices. For example, the government gave incentives to use renewable energy like wind and solar. Thus they reduced the demand for oil to some extent. Another aspect, the oil output of Non-OPEC countries increased gradually, especially the output in Britain and Norway—a new big oil field was discovered in the North Sea. And sooner the light oil founded in North Sea turned out to be more popular than Gulf crude oil. Thirdly, the inter-instability of OPEC for being a cartel began to emerge. The term cartel is an economic term. It is a formal agreement among firms. Cartel members may agree on such matters as price fixing, total industry output, market shares, allocation of customers, allocation of territories, bid rigging, establishment of common sales agencies, and the division of profits or combination of these.<sup>12</sup> However, Cartel is a weak organization. There are incentives and opportunities for its every member to privately break the agreement. Hence the members of OPEC consistently over-produced the agreed output, weakening the OPEC's ability to control oil production. Thus after the two oil crisis, the OPEC still can not get the power of controlling world oil price. But it is the most influential factor to oil price.

### **1.2.3 Oil market during 1980~2002**

Oil price in this period fluctuated frequently, but the range was not so great as in 1970's. High oil prices in "oil crisis" stimulated a lot investment in oil production. But after the crisis, the demand of oil decreased. Thus international oil market appeared to be over-supplied. Then oil price began to decrease considerably to around \$25/barrel; due to the OPEC's official price system could not instantly reflect the variable price during and after the two energy crisis, the Great Britain and Holand related its oil product with spot market price rather than the OPEC's official price. Spot market was transformed from "Residential Market"<sup>13</sup> to the price-determining market in 1985. The same year, by fearing the competition of Non-OPEC, members of the OPEC's began to largely increase their output despite the limitation rules, trying to seize more market share. That caused the world oil price decreased to \$13.53/ barrel in 1986. In 1987, it raise a little because of the intense situation in Gulf War. But it fell down

again very soon.

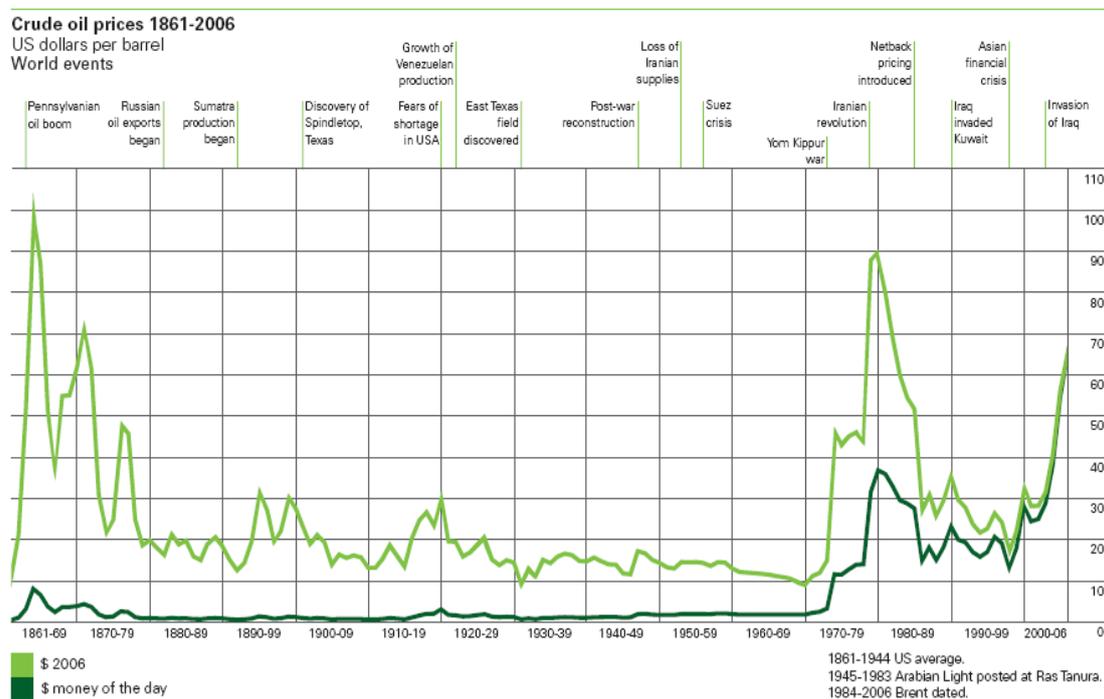
The turning point appeared in 1989. The yield of the Non- OPEC members began to drop, but world’s oil demand conversely ascended, causing the oil price grew. In August, 1990, with the outbreak of Gulf War, the oil-depending countries worried that the situation would get worse, thus they began to deposit oil in large-scale which resulted in the petroleum price further growing.

In 1998, due to the lash of financial crisis, Southeast Asia’s economy suffered a serious wound and so the world. The demand to petroleum in some Asian nations, such as Japan and Korea, significantly reduced; however, the OPEC increased the petroleum produce of quota at the same time, which caused considerable decrease in oil price. The oil price on the international market declined to the lowest level since 1973 in 1998, which is \$3.19 exempting inflation factor.

The oil price attained another peak in 2000, and then tailed off in 2001.

### 1.2.4 Oil market after 2003

After 2003, the oil price goes all the way up. Finally, it reached to \$100/barrel by the end of 2007. This situation resulted from various kinds of factors such as the war between the USA and Iraq, the deflation of US dollars, people’ s anticipation and the hedge funds’<sup>①</sup> speculation<sup>②</sup> activities on oil futures market and so on.



Graph 1.5: World crude oil prices 1861-2006

Source: BP’s Historical Data. [http:// www.bp.com](http://www.bp.com)

<sup>①</sup> Hedge fund is a private investment fund which is seeking opportunities to gain profit in all kinds of financial market such as futures market, bond market and so on.

<sup>②</sup> Speculation is a financial term which is frequently used in futures market and bonds market. It is referring to those trade behaviors that aiming to gain profit from price difference between buying and selling.

## **2. Spot market**

### **2.1 Definition**

In our daily life, we deal with spot trades almost every day. No matter you buy a cup of coffee in Mc-Donalds or purchase 10 liter gasoline in a gas station, as long as you pay for the goods at instant and get it immediately, those trades can be regarded as spot trades. However, the mentioned places where the spot trades happen are not spot market. Spot market is referring to the market where numerous large-scale spot trade happens. Take oil as an example, there are thousands of gas stations, where oil products are traded by the unit of liter, they can not be considered as spot market. On oil spot market, oil products are traded by the unit of ton or barrel. For better transportation, the oil spot markets usually locate in harbors, such as Rotterdam, New York Harbor and the U.S. Gulf Coast.

### **2.2 The origin of oil spot market**

Viewing the history of oil trade in the last section, we know that before 1970's oil was mainly traded through long-term contracts between companies or between companies and governments. Spot market was only used as a way to balance supply and demand. When a company temporarily had some extra supply for its own needs, it would sell some in the spot market. Likewise, if it needed some additional volumes to meet a demand peak, or because supply is unexpectedly curtailed, it would purchase oil on a spot market. Thus the spot market was regarded as "residual market" at that time.<sup>13</sup> But after the two "oil crisis" in 1970's, due to the oil price fixed in long-term contracts could not reflect the supply and demand situation, more and more traders took part in the spot market. For example, during the oil embargo in 1973, the oil prices set in long-term contracts were generally about 5 dollars per barrel. However, the price on spot market reached high to \$17 per barrel.<sup>14</sup> The oil sellers felt that it was more profitable to sell oil on spot market, so some of them defaulted the contract and sold the oil which was planned to sell through long-term contract on the spot market. Then the oil buyers who were short of oil supply had to purchase oil on spot market. The prices in spot market could send a clear signal about the supply and demand balance----rising price implied that demands were over supplies meanwhile dropping price indicated that there were too much supplies relative to demand. Meanwhile, the prices reported on spot market were relatively transparent; it could provide critical price information for the long-term contract trade. For example, a July delivery contract will tie its price to the price of the same product on spot market in July.

Right now, the famous oil spot markets are: Rotterdam for Northwest Europe, New York Harbor for U.S. Northeast, Chicago for U.S. Midwest, Singapore for South East

Asia, and the U.S. Gulf Coast.<sup>15</sup> Differing from other commodities, which usually delivered at instant in spot trade, crude oil will be delivered from 2 to 15 days in spot trade<sup>16</sup>.

## 2.3 Cash Price<sup>17 18 19</sup>

Most of the crude oil that flows into international trade is priced by this formula:

$$P=A+D.$$

In this formula, A stands for a base price, which based on a market indicator. A market indicator is a kind of oil which is most actively traded in a market. It usually has high quality (easy to refine) and its price has the widest acceptance both from oil sellers and buyers. For example, for crude oil sold to the U.S, the base price is usually the price of West Texas Intermediate (WTI) crude oil; for crude oil sold to Europe, the base is the price of North Sea's Brent Blend oil; and for crude sold to Singapore and South East Asian countries is based on Dubai.<sup>20</sup> D represents the price adjustments comparing the quality to base oil. If the quality of the oil is better than the base oil, then D should be a premium; otherwise, D should be a discount. Usually, oil with low sulfur is regarded as higher quality than that with high sulfur; hence its price will be higher than oil with high sulfur.

Here are brief introductions of four important base oils used in world oil trade.

### West Texas Intermediate

West Texas Intermediate (WTI) crude oil, which is also known as Texas Light Sweet, is high quality oil. Its API gravity<sup>①</sup> is 39.6 degrees while the rate of sulfur is only about 0.24 percent. Those characteristics made it easily to refine. Thus it is one of the most popular oil in world oil market. WTI crude oil is used as a benchmark of oil pricing in the Americas or crude oil exported to the Americas. WTI is also the underlying commodity of New York Mercantile Exchange's famous oil futures contract---Light Sweet Crude Oil futures contract.

### Brent Blend

Brent Blend crude oil is mixed of light sweet oil which is sourced from the North Sea. Brent Crude has an API gravity of around 38.06 and contains 0.37% of sulfur, which make Brent an ideal for production of gasoline and middle distillates.<sup>②</sup> But Brent is not as sweet as WTI, Thus there is usually about \$1 to \$2 per-barrel discount to WTI.

Brent is used as a benchmark of oil pricing for the crude oil in Europe or exported to Europe. That is to say any crude oil traded in Europe, the price of that oil will be tie to the price of Brent crude. If the quality of the trading oil is considered better than

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<sup>①</sup> API gravity: it is a measure of how heavy or light is when comparing to water. If it is greater than 10, the oil will float on water; if it is less than 10, it is heavier and sinks.

<sup>②</sup> See "refining",  
[http://www.eia.doe.gov/pub/oil\\_gas/petroleum/analysis\\_publications/oil\\_market\\_basics/refining\\_text.htm](http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/refining_text.htm)

Brent, its price equals to the price of Brent plus a certain premium. And if its quality is poorer than Brent, its price equals to Brent's price minus a proper discount. Brent is also the underlying commodity of International Continental Exchange's famous Brent crude oil futures contract.

## **Dubai**

Dubai Crude is produced in the Emirate of Dubai, part of the United Arab Emirates. Dubai Crude is generally used for pricing Persian Gulf crude oil exports to Asia. In July 2007, Dubai Mercantile Exchange was established. And Dubai crude is underlying commodity of the Omani crude futures contract. Dubai Crude has a gravity of 31° API and a sulfur content of 2%wt<sup>①</sup>, which means it is not so light and sweet as WTI and Brent. Hence its price usually \$5-\$6 lowers than WTI and Brent.

## **OPEC's official price<sup>21</sup>**

In early 1970's, in order to repel western oil companies' "price decrease" strategy, the OPEC began to publish the prices of standard oil every ministerial conference. The standard oil prices are using Arabic Light (API 34) as a basis. And the publication prices are the official prices.

However, when entering 1980's, due to the increase in Non-OPEC's output, the OPEC's official price was not so much useful in controlling the trade price. Thus the OPEC changed it to OPEC Basket Price. It is a weighted average of prices for petroleum blends produced by OPEC countries. It is used as a benchmark for pricing crude oil produced by the OPEC members. Before June 15, 2005, it included: Saudi Arabia's Arab Light (API 34), Algeria's Saharan Blend (API 44), Nigeria's Bonny Light (API 37), Indonesia's Minas (API 34), Venezuela's Tia Juana Light (API 31), Dubai's Fateh (API 32), and Mexico's Isthmus. However, on that day, OPEC changed its basket combination. Right now the OPEC basket price stands for the average price of: Saharan Blend (from Algeria), Minas (from Indonesia), Iran Heavy (from Islamic Republic of Iran), Basra Light (from Iraq), Kuwait Export (from Kuwait), Es Sider (from Libya), Bonny Light (from Nigeria), Qatar Marine (from Qatar), Arab Light (from Saudi Arabia), Murban (from UAE), and BCF 17 (from Venezuela).

To sum up, WTI and Brent crude oil are the most two important benchmarks of world crude oil. Their prices are reported every day, and are the indicators of current world crude oil price situation. WTI and Brent have their own futures traded on New York Mercantile Exchange (NYMEX) and ICE. And the futures prices play an important role in determining their spot price. That is why the prices reported every day are the futures prices. We will discuss the details in the next section.

## **3. Forward market**

The majority of crude oil is traded in the way of forward trade. According to

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<sup>①</sup> Weight percentage. Sulfur wt% = (sulfur weight/ total weight)\*100%

Reuters' statistics, only 10% of the crude oil is traded on spot. It is mainly because the exploring, refining, stocking and transportation processes are expensive and will take a lot of time. Thus it is better for the producers to know the demand situation in advance and then to make the producing plan.

Forward contracts are traded in two places: OTC and exchange; Meanwhile, it is achieved through many different contracts. And the most important one is futures contract. This section covers the usual traded contracts in crude oil trade, the origin of modern futures exchange as well as the involvement of crude oil futures contract.

### **3.1 Crude oil derivatives<sup>1</sup>**

#### **Forwards contract**

Forwards contract is an agreement to buy or sell an asset at a future time for a certain price. There are forwards contracts involving metal, energy products, interest rate and exchange rate. Forwards contracts are traded OTC rather than in an exchange. OTC is referring to a market with following characteristics: no fixed trading place, fewer constraint rules on transactions and to an extent more internationalized.<sup>16</sup> It can be a bank or a private financial agency. Traders deal with transactions through face-to-face negotiation, telephone or internet; they don't have to go to the crowded and noisy exchange. Since forwards contract is traded privately, its contents, such as trading amount, price, delivery time and location are usually specified for both trading parties. This also makes forwards contracts hard to be transferred to the third party.

There are forwards markets of Brent Blend and WTI. And Brent Blend 15-days forwards market is the largest and most important crude oil forwards market.<sup>16</sup> The buyer is informed 15 days in advance to take the cargo in the harbor Sullom Voe<sup>①</sup>.

#### **Futures contract**

Like a forward contract, futures contract is also an agreement between two parties to buy or sell an asset at a certain time in the future for a certain price. But differing from forwards contract, the features of the contract except the price are standardized by the exchange not by the trading parties themselves. The contract specifications include the quantity, quality of the item, and the delivery procedure and delivery month. All these make futures contracts easy to be transferred amid traders.

Futures contracts are launched by exchange, and they are only traded in exchange. An exchange is a place specified for people trading standardized contracts like futures contract. Each exchange no matter it is profit-seeking or non profit-seeking is regulated by a national governmental agency. For example, the three commodity exchanges in China including Shanghai, Zhengzhou and Dalian exchange, they are all regulated by Chinese Securities Regulatory Commission. Futures contracts can be traded through two ways. They can be traded by outcrying in the hall of exchange or through the exchange's electric trading system which is available almost the whole day. Traders don't have to know each other.

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<sup>①</sup> It is an inlet between North Mainland and Northmavine on Shetland in Scotland

The market for commodity futures contracts is divided into four major segments: metals and energy, corn and oilseeds, livestock and meat, and food and fiber. (see Table 3.1) Crude oil futures in energy section have the greatest trading volume among all commodity futures. Two of the world’s most important crude oil futures—WTI (light sweet crude oil) and Brent futures contracts are traded on NYMEX and ICE.

**Table 3.1 Major Classes of Commodities**

Grains and Oilseeds		Metals and Energy	
Corn	Soybean oil	Electricity	Palladium
Oats	Wheat	Copper	Gasoline
Soybeans	Canola	Gold	Heating oil
Soybean meal	Rice	Platinum	Crude oil
		Silver	Natural gas
Livestock and Meat		Food and Fiber	
Cattle-live	Hogs	Cocoa	Sugar
Cattle-feeder	Pork bellies	Coffee	Cotton
		Milk	Lumber
		Orange juice	

Source: <sup>①</sup>

## Options

Options are financial instruments that convey the right, but not the obligation, to engage in a future transaction on some underlying security. For instance, you have an option contract with a crude oil supplier that to buy 10,000 barrels crude oil next month at the price of \$120 per barrel. Let’s assume the option costs you \$10,000. However, during this month, you find that another oil supplier can provide you 10,000 barrels crude oil at the price of \$115 per barrel. Then you could not fulfill the option contract with the first oil supplier. For that you know that if you purchase from the second oil supplier the total cost will be lower.<sup>②</sup> If you can not find any cheaper oil during this month, you can still purchase from the first supplier. So that is why we say options contract is a kind of contract which gives you the right but not the obligation to buy or sell. Whether to use the right or not will be your decision. This distinguishes options from forwards and futures for that the holder is obligated to buy or sell the underlying asset. There are two basic types of options. A call option give the holders the right to buy a specified amount of a security at a set price at some time on or before expiration; meanwhile a put option provides the right to sell. Options can be traded either in exchange or OTC. Options which are standardized by exchange are traded on exchange, facilitating independent parties. Options which are negotiated by trading parties are traded OTC.

Now, we can summarize the differences between derivatives traded in exchange

<sup>①</sup> Gitman and Joehnk, “Fundamentals of Investing”, Person, 2008

<sup>②</sup>  $115 * 10000 + 10000 = 1,160,000 < 120 * 10000 = 1,200,000$

and OTC.

Table 3.2 Differences between derivatives on Exchange and OTC

Exchange	OTC
<ul style="list-style-type: none"> <li>• Derivatives               <ul style="list-style-type: none"> <li>• Futures</li> <li>• Options</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Derivatives               <ul style="list-style-type: none"> <li>• Forwards</li> <li>• Options</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Traded through outcry or exchange or electronic system</li> </ul>	<ul style="list-style-type: none"> <li>• Traded privately through negotiating</li> </ul>
<ul style="list-style-type: none"> <li>• Standardized contract; launched in public</li> </ul>	<ul style="list-style-type: none"> <li>• No standardized contract</li> </ul>
<ul style="list-style-type: none"> <li>• Participants do not have to know each other</li> </ul>	<ul style="list-style-type: none"> <li>• Participants must know each other</li> </ul>
<ul style="list-style-type: none"> <li>• Contracts are easy to be transferred to the third party</li> </ul>	<ul style="list-style-type: none"> <li>• Contracts can not be easily transferred to the third party</li> </ul>

Source: <sup>①</sup>

### 3.2 Why we need derivatives

There are plenty of advantages in spot trade, for instance the purchaser can identify the quality of the goods personally while the seller can get the money instantly without worrying that one does not pay for it. It sounds like a win-win policy. Then why do we need to trade things that will be delivered in future? To sum up, there are two factors make derivatives necessary. First of all, in large-scale commodities trades, a seller needs certain time to prepare those goods. For instance a refiner wants buy 10000 barrels of light sweet oil, it seems impossible for a seller always has so much oil for selling immediately. Besides, for such large amount of goods, the transportation as well as storing would be great problems. Thus, usually both sides of the trade would take certain time to negotiate those questions first, and after that they will sign an agreement which determines the price and the future delivery time of the trading asset. That is the so-called “Forward Contract”. Then both sides can arrange their business according to this contract before the final delivery time.

The second factor is that, both trading sides want to lock the price of the asset. We know that numbers of commodities, especially agricultural products, are of strong seasonality and easily influenced by natural surroundings. Thus the price of goods is hard to predict. When weather is good, agricultural plants get great harvest. The price of farm products will go down and vice versa. Farmers may worry about that they can not sell a profitable price due to over-supply during harvest time so they may sell the goods months before. On the other hand, the food merchant is afraid that the price will grow as a result of short supply in harvest time. Then he would like to buy in

<sup>①</sup> Reuters, “An Introduction to Derivatives”, Peking University Edition, 2001

advance.

For example, in March, the price of WTI crude oil is 105 dollars per barrel. An oil exploring company signs a forward contract with an oil refiner promising to deliver 10000 barrels of WTI crude oil in May at the price of \$115 /barrel. If the price on spot market is \$110 per barrel, the company could avoid the loss of \$50000  $[(115-110)*10000]$  due to the forward contract with the refiner. However, if the price rises to \$120 per barrel, the refiner still can purchase oil at the price of \$115 per bushel according to the forward contract. Thus he can avoid the loss of \$50000  $[(120-115)*10000]$ . In short, both of them lock the price at \$115 per barrel.

Although trading with forward contracts can reduce the risk of price fluctuation, it also cut down the opportunities to make some extra profit. Take the last case as an example, when the price reaches to \$120 per barrel, it is more profitable for the exploring company to sell corn directly on spot market than to honor the forward contract, whose price is \$115 per barrel; meanwhile, if the price decreases to \$110 per barrel, the refiner will find that it is more attractive to buy crude oil on spot market. Due to these reasons, one of the traders is very likely to dishonor the contract.

Besides, when one party dishonors the contract, it is hard to sell the contract to new traders. Because the contract is made especially for the original traders and the terms on it may not meet the requirements of the other customers. For instance, the refiner does not need the 10000 barrels oil in May. Then he finds three buyers to negotiate. Let's say buyer A, B, C. After reading the contract, A thinks that the delivery place is not suitable; and B considers that the quality of oil can not meet the standards; although C feels both the delivery place and quality are OK, it only needs 5000 barrel. Such cases as those block the way for the contract to be conveyed successfully.

To solve those problems, futures contract and exchange are established. Futures contract can be regarded as a standardized forwards contract. It is launched by exchange and traded on exchange. Exchange handles the transactions, helps buyers (seller) find sellers (buyers) and gives them a guarantee that the contract will be honored. As to how exchange can guarantee that, we will analyze in the fifth chapter.

### **3.3 The evolvement of oil futures**

Futures contract has a history of 160 years since the establishment of Chicago Board of Trade in 1848. It started in the agriculture segment. And then it spread to energy, metal, financial assets and so on. Now crude oil futures contract is the single most actively traded futures contract among all commodity futures contracts around the world. (See Table 3.3)

The history of oil futures is not as short as many people think. As a matter of fact, in the last half of 19's century, a "gasoline exchange" has been booming in New York for a while.<sup>22</sup> In the early 30's of 20th century, there was an oil futures market in California.<sup>22</sup> However, this kind of oil futures was vanished very soon because large multinational oil companies and American government reconstruct stable market structure of monopoly. Hence, oil futures market lost the precondition to be born.

In 1973, Arab's embargo caused oil price rising sharply. Thus, New York Cotton

Exchange firstly introduced a crude oil contract which was traded in Rotterdam (to avoid price regulation in America).<sup>23</sup> Nevertheless, this effort still ended with failure. It is because the American government kept executing price control and meanwhile the oil trade players held a skeptical attitude to oil futures market.

The first successful futures contract was for heating oil introduced on the New York Mercantile Exchange (NYMEX) in 1978, followed by a contract for leaded gasoline in 1981.<sup>24</sup> At the same time the International Petroleum Exchange (IPE)<sup>①</sup> in London opened for trading gas-oil futures.

A crude oil futures contract was introduced by NYMEX in 1983, using West Texas Intermediate (WTI), a light sweet crude, delivered at Cushing, Oklahoma as the benchmark.<sup>24</sup> Later, IPE introduced a similar contract for Brent in the United Kingdom in 1988.<sup>25</sup> The NYMEX introduced an options contract for WTI in 1986. By 1990, 10 active futures contracts relating to crude oil and crude oil products were traded on commodities markets worldwide, with a combined equivalent of over 150 million barrels purchased and sold each day.<sup>22</sup> Today, NYMEX alone handles that much.

When entering 1990's, gas futures became one of the energy futures type.

Right now, after more than 20 years' development, under the efforts of New York, Chicago, London, Tokyo and Singapore exchanges, several kinds of oil futures as well as options has been launched in market. Those includes the WTI crude oil, Brent crude oil, heating oil, rboob gasoline<sup>②</sup> and natural gas futures and options contracts on NYMEX; WTI crude oil, Brent crude oil, gas oil and natural gas futures and options contracts on ICE; there are several oil products futures contracts traded in Tokyo Commodity Exchange and Shanghai Futures Exchange and all over the world, such as fuel oil and diesel futures contracts and so on.

<b>Graph 3.3: TOP 5 Commodity Futures and Options Contracts</b>					
<i>Ranked by Number of Contracts Traded and/or Cleared</i>					
Rank	Contract	Jan-Oct 2007	Jan-Oct 2006	% Change	
1	Crude Oil Futures, NYMEX	101,526,321	56,759,536	78.87%	
2	Brent Crude Oil Futures, ICE Futures Europe	50,225,049	36,688,912	36.89%	
3	ICE WTI Crude Oil Futures, ICE Futures Europe	43,363,529	22,260,285	94.80%	
4	Natural Gas Futures, NYMEX	24,960,139	19,398,401	28.67%	
5	Crude Oil Options on Futures, NYMEX	23,243,726	17,824,564	30.40%	

Source: "Trading Volume", <http://www.futuresindustry.org/>

### 3.4 Why the oil futures is introduced<sup>26</sup>

After viewing the oil trade history, we may conclude the following two reasons

<sup>①</sup> It is called ICE right now.

<sup>②</sup> A gasoline futures contract traded on NYMEX

why oil futures contracts were introduced in the early 1980'.

First of all, oil is traded more freely after 1980's. As we know, the OPEC controlled the output of crude oil and increased its price by establishing an "official" price in the early 1970's. As the production base expanded in response to rising prices, and with the development of spot markets, producer nations found it increasingly difficult to maintain the price they had agreed to. So, in 1986 OPEC abandoned its strategy of defending a price.<sup>27</sup> After the OPEC's price strategy began to disintegrate, the markets in crude oil and crude products came to behave more like those of other commodities. Individual pricing services appeared that report detailed place and time transactions, increasing market transparency. Price became volatile in respond to supply and demand pressure. We know that one of the basic conditions to make a successful futures contract is that the price of the underlying commodity must be very volatile. If a commodity's price is always stable, there is no need to design a futures contract for it because people know that he or she can buy the commodity at a predictable price on spot market any time. Hence no one would buy its futures contract. Since oil price became volatile, people feel that there is a very need to bring out oil futures.

The second reason is that the western countries are trying to seize power of oil pricing. Oil was compared to be the industry blood to western countries. For a long time before 1970's, the output and price of oil products were mainly controlled by giant oil companies---- the "Seven Sisters". However, with the enhancement of sense of independency, Middle East realized that they could use oil as a weapon to resist western countries. Especially after the establishment of the OPEC, western countries gradually lost their power on oil production and price. In 1973, the famous Middle East war broke out, which caused oil price increasing 4 times. Hence it resulted in the most serious "Economic Crisis" since the Second World War. And the USA, Japan and Europe suffered a lot. So they were trying to use oil futures to take back the pricing power. Now, Brent futures contract is used as a benchmark for oil exported to Europe; meanwhile, WTI futures contract is the price benchmark for oil exported to the USA so as to the whole America. Basically, the western powers have controlled the oil price again.

## **4 The fundamentals of (oil) futures**

In section 4.2, we mentioned that the establishment of futures can solve the two problems in contract trade: firstly, there is huge risk that the forward contract might not be honored; and secondly, the contract is hard to transfer to a third party. But how futures can avoid these problems? In this chapter, we will discuss the details of how futures market works. The content covers the specification of futures contract, the mechanics of margin system and the exchange's organization.

## 4.1 Standard Contract

When developing a new contract, the exchange must specify in details the exact nature of the agreement between the two parties. That is, it must specify the asset, the contract size (how much is presented by one contract), where delivery will be made and when delivery will be made.

### The Asset

Crude oil comes in many varieties and qualities, depending on its specific gravity and sulphur content which depend on where it has been pumped from. Thus it is very important to specify it. When the oil is specified, the exchange should stipulate the grade or grades are acceptable by exchange. The NYMEX has specified the asset in its light sweet crude oil futures contract as:

*Specific domestic crudes with 0.42% sulfur by weight or less, not less than 37° API gravity nor more than 42° API gravity. The following domestic crude streams are deliverable: West Texas Intermediate, Low Sweet Mix, New Mexican Sweet, North Texas Sweet, Oklahoma Sweet, South Texas Sweet.*

*Specific foreign crudes of not less than 34° API nor more than 42° API. The following foreign streams are deliverable: U.K. Brent, for which the seller shall receive a 30 cent per barrel discount below the final settlement price; Norwegian Oseberg Blend is delivered at a 55¢-per-barrel discount; Nigerian Bonny Light, Qua Iboe, and Colombian Cusiana are delivered at 15¢ premiums.<sup>24</sup>*

With this specification, the buyers do not have to worry that they will receive crude oil with poor quality. Because all the crude oil traded on exchange is strictly checked by the staff of exchange according to the quality specification. Those which do not reach this specification can not be traded on exchange. Meanwhile, with this precise specification, the crude oil sellers know exactly what kind of oil they should prepare. Hence they can make more efficient producing plan.

For crude oil, a range of grades can be delivered, such as WTI, Low Sweet Mix, but the price received depends on the grade.

### The Contract Size

The contract size means the amount of assets will be delivered for one contract. This is very important because if the contract size is too large, many investors who are willing to buy relatively small amount may not be able to buy it. If the contract size is too small, the trading will be so expensive because every contract will have a commission charge. This will greatly reduce investors' interests. Either too large or too small will reduce the number of investors, hence decreasing the liquidity of futures.

The normal light sweet crude oil futures contract in the NYMEX stands for 1000 barrels oil, which is 42,000 gallons. In NYMEX, there is another crude oil futures contract called miNY futures contract, which is the same with light sweet crude oil futures contract except its size is 500 barrels. This is provided for small-scale sellers

and buyers.

### **The Delivery Arrangements**

The exchange must specify where the delivery should be made. This is especially important for those commodities which have significant transportation cost. For example, the NYMEX's light sweet crude oil futures contract specifies the delivery as:

*F.O.B.<sup>①</sup> seller's facility, Cushing, Oklahoma, at any pipeline or storage facility with pipeline access to TEPPCO, Cushing storage, or Equilon Pipeline Co., by in-tank transfer, in-line transfer, book-out, or inter-facility transfer (pumpover).<sup>24</sup>*

It means the oil traded through futures contract on NYMEX should be delivered to Cushing, Oklahoma through pipeline or other storage facility before the futures contract is matured. However, if the traders have special requirements, they also can deliver goods in other place. But there are strict rules on that. In the case of the light sweet crude oil futures contract on NYMEX, it is specified like:

*An alternate delivery procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.*

The exchange will decide whether traders can deliver assets in another place and whether there is a need to make some adjustment to the contract's price due to the difference in transportation cost.

In general, only about 1% of all futures contracts are settled by delivery. In the rest, there are only "cash changing hands", and "then only the difference between the purchase or sales amounts in the futures contracts and the market value of 1,000 barrels on the delivery date — not the oil itself."<sup>28</sup>

### **Trading & Delivery Months**

Futures contracts are sorted by delivery month. The delivery month specifies when the commodity or item must be delivered. For instance, light sweet crude oil futures contract in NYMEX are listed in this schedule: consecutive months are listed for the current year and the next five years; and the June and December contract months are listed from the sixth year to ninth year. It means that, for example, let's assume today is 2<sup>nd</sup>, January, 2008; there are futures contracts delivered every month from 2008 to the next five year, which is 2013. And from 2014 to 2017, there are only June and December delivered futures contracts. When entering 2009, the schedule will move forward, that is from 2009 to 2014, futures contracts are designed to deliver every month. From 2015 to 2018, there are only June and December delivered futures contracts. (See Table 4.1 and 4.2) Usually, the delivery can be made after the first calendar day and completed by the last calendar day of the delivery month. Contract trading ceases a month or days before the last day on which delivery can be made. For

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<sup>①</sup> FOB is an abbreviation for Free On Board. It means the buyer will responsible for the transportation, damage and so on, all the risks since the goods cross the shipping point to be delivered.

example, the May light sweet crude oil futures contract trading terminates at the close of business on the third business day prior to the 25th calendar day of April.

Table 4.1 The list of Light Sweet Crude Oil Futures on NYMEX 2 <sup>nd</sup> , Jan, 2008										
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Month	The current year and the next five years, contracts are delivered every month						From 6 <sup>th</sup> -9 <sup>th</sup> year, contracts are delivered Jun and Dec			
Jan	expired	✓	✓	✓	✓	✓				
Feb	✓	✓	✓	✓	✓	✓				
Mar	✓	✓	✓	✓	✓	✓				
Apr	✓	✓	✓	✓	✓	✓				
May	✓	✓	✓	✓	✓	✓				
Jun	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Jul	✓	✓	✓	✓	✓	✓				
Aug	✓	✓	✓	✓	✓	✓				
Sep	✓	✓	✓	✓	✓	✓				
Oct	✓	✓	✓	✓	✓	✓				
Nov	✓	✓	✓	✓	✓	✓				
Dec	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: [www.nymex.com](http://www.nymex.com)

Table 4.2 The list of Light Sweet Crude Oil Futures on NYMEX 2 <sup>nd</sup> , Jan, 2009										
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Month	The current year and the next five years, contracts are delivered every month						From 6 <sup>th</sup> -9 <sup>th</sup> year, contracts are delivered Jun and Dec			
Jan	expired	✓	✓	✓	✓	✓				
Feb	✓	✓	✓	✓	✓	✓				
Mar	✓	✓	✓	✓	✓	✓				
Apr	✓	✓	✓	✓	✓	✓				
May	✓	✓	✓	✓	✓	✓				
Jun	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Jul	✓	✓	✓	✓	✓	✓				
Aug	✓	✓	✓	✓	✓	✓				
Sep	✓	✓	✓	✓	✓	✓				
Oct	✓	✓	✓	✓	✓	✓				
Nov	✓	✓	✓	✓	✓	✓				
Dec	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: [www.nymex.com](http://www.nymex.com)

### Price Quotes

The futures price should be quoted which is easy to understand and convenient to

trade. The light sweet crude oil futures contract on NYMEX is quoted U.S. dollars and cents per barrel. The Brent crude oil futures contract on ICE is also quoted by U.S. dollars and cents per barrel. Right now, there is no crude oil futures contract which is not quoted by other currency.

Due to the mainly traded crude oil worldwide is quoted U.S. dollars, the value of this currency greatly influence the oil's price. During the constant depreciating of U.S. dollars of the recent months, the crude oil's price went all the way up to \$119 per barrel, reaching its history peak price. Although there are other factors brought on this high price, the devaluing of dollars is the main reason.<sup>29</sup>

## 4.2 Operation of Margin<sup>30 31 32</sup>

The margin system can assure that all the futures contracts will not be defaulted. Besides that, margin system also utilizes the concept of leverage<sup>①</sup> in investing in futures market. In general, margin system is the base of modern futures trade.

### 4.2.1 What is margin

In some circumstances, if one orders a large amount of goods in advance, he will be required to pay part of the goods as a guarantee. This is trying to reduce the risk that the buyer will default. And the money is usually known as margin. By this way, if the buyer refuses to buy the goods he has ordered when the delivery time is reaching, he will not able to get the paid money back. That means if the buyer dishonors the agreement, he will margin as a punishment.

The principle of margin in futures trade is more or less the same with the above example. However, unlike the normal margin, which was paid for one time, the margin required in futures exchange is calculated every day varying with the relative commodity's price. The person whose margin has not reached the requirements and will not able to add money in time will be eliminated from the market as soon as possible. Hence, the mechanism of margin greatly reduces the risk that the futures contracts will not be honored.

To illustrate how margins work in detail, we consider an investor who wishes to buy two October light sweet crude oil futures contracts on NYMEX on May. We suppose the futures price is \$115 per barrel. For the contract size is 1000 barrels, thus the investor has contracted to buy 2000 barrels at that price. First of all, he should contact a futures broker<sup>②</sup> and open a margin account in the broker company. Then the broker will require the investor to deposit certain money in the margin account which is known as initial margin. How much money depends on the requirements of the futures exchange and the broker<sup>③</sup> company. According to the NYMEX, the member

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<sup>①</sup> The potential outcome of using the given resources is magnified.

<sup>②</sup> Individual is not allowed to trade futures directly on Exchange, he/she must open an account in a broker company which is entitled to trade on the Exchanges.

<sup>③</sup> Broker plays as an intermediate between contracts buyers and sellers.

customer<sup>①</sup> initial margin is \$7,150 per contract. If the broker company has no more requirements on margin<sup>②</sup>, the investor should at least deposit \$14,300 ( $7150 \times 2$ ) in its margin account. However, it also means that the investor can buy up to \$ 230,000 ( $\$115 \times 2000$ ) worth of crude oil for \$ 14,300. This is what we call a “leverage function.” One can buy a contract with only paying 5%~10% of its value.<sup>③</sup> At the end of each trading day, the margin account is adjusted according to the futures price of that day, reflecting the investor’s profit or loss. This practice is known as “mark-to-the-market” the account.

Suppose that by the end of the first trading day, the futures price increase to \$119 per barrel. The investor has a profit of \$8000 [ $=(119-115) \times 2000$ ]. Because the 2,000 barrels which the investor contracted to buy at the price of \$115 per barrel now can be sold at the price of \$119 per barrel. Finally, the 2000 dollars will be added into the investor’s margin account. So there will be \$9,150 in his account in total. Similarly, if the price drops to \$112 per barrel, the investor suffers a loss of \$6000 [ $=(115-112) \times 2000$ ]. For that the oil which he bought at the price of \$115 per barrel now only sold at the price of \$112 per barrel. Then 6,000 dollars will be moved from his margin account, leaving only \$1,150 in it.

In the subsequent days, as long as the investor has not sold the contracts, his margin is marked to market by the end of each trading day.

For example, let’s say at the close of the first trading day, the futures price grows to \$119 per barrel. Thus there is 9,150 dollars in his margin account. And then the exchange will consider the investor bought those contracts at the price of \$119 per barrel rather than \$115 per barrel. However, by the end of the second day, the futures price decreases to \$118 per barrel. The investor has a loss of \$1000 [ $=(119-118) \times 1000$ ]. The balance of margin will be decreased by \$1,000 to \$8,150. And the exchange will consider that the investor bought those futures contracts at the price of \$118 per barrel. In the following days, if only he holds the two contracts, his margin account will be calculated every day in this way.

We must notice that either the money paid to the investor or the money took away from the investor’s account does not belong to the exchange. When the futures price decreases to \$112 per barrel, the margin of the person who has bought the futures contract is decreased by \$6000. The broker will pay the money to the exchange, and the exchange passes it to the broker of the person whose has sold the futures contract. Likewise, if the price increases, the money will be passed from the person who sold futures contract in advance to the person who bought futures contract.(see graph 4.3)

There is a maintenance margin, which is lower than the initial margin, standing for the lowest level of money required by exchange. For example, according to NYMEX’s light sweet crude oil futures contract maintenance margin requirement, the money in an investor’s account can be no less than \$6,500 per contract. It means that once a customer’s money in the margin account is less than \$6,500 per contract, he will immediately receive a margin call and is expected to add margin to the initial

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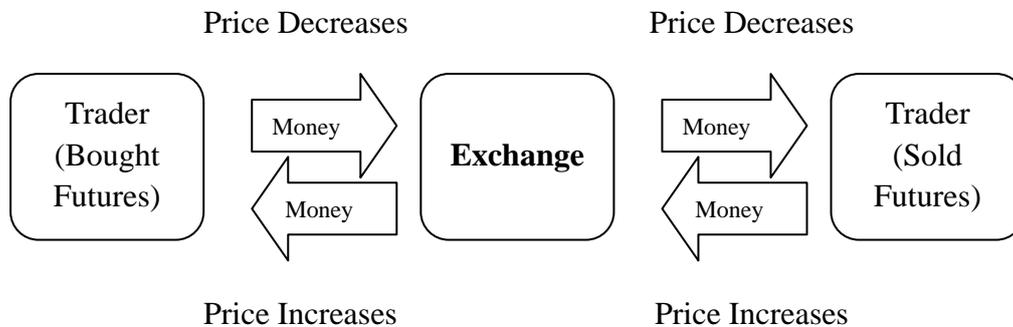
<sup>①</sup> The non-member initial margin is \$8,750. In this thesis, all the brokers mentioned are considered member customer of the Exchange.

<sup>②</sup> Some broker companies will require more margin than that of the Exchange, for reducing risk.

<sup>③</sup> Note that one must pay the full price of the underlying commodity when delivering.

margin level next day. If he can not make it next day, all the contracts he holds will be offset according to the current price. And the investor's margin account will be closed. He can no longer trade futures contract until he gets enough money to begin trade.

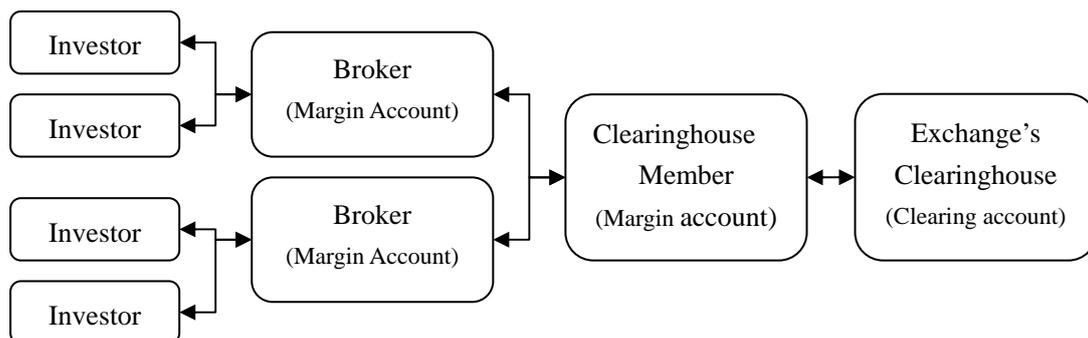
Graph 4.3: The cash flow between traders when price increases or decreases



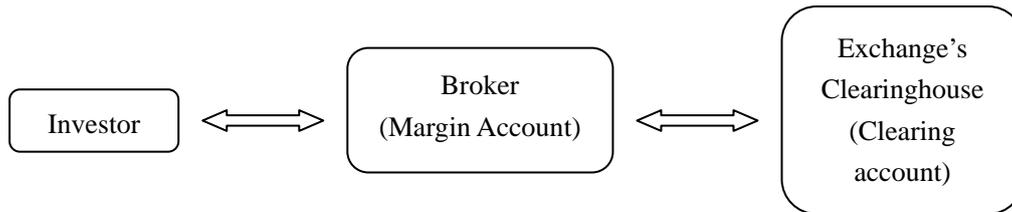
### 4.2.2 The Clearinghouse

The clearinghouse is a section of the exchange and “acts as an intermediary in futures transactions”.<sup>1</sup> The clearinghouse has certain numbers of members. Each member has a margin account called clearing margin account in the clearinghouse, just like the investor's margin account in its broker company. At the end of each day, the clearinghouse calculates the losses or gains of each account in the way as are the margin account of investor's, deciding to take or add money to the account. All the transactions are tracked by clearinghouse, hence brokers who are not clearinghouse members must engaged their business through a member.

Graph 4.4: The mechanism of margin system (1)



The money flows in every transaction can be illustrated by the above graph. Usually, a broker company is also a clearinghouse member. Hence the graph can be simplified like this: (see next page)



Graph 4.5: The mechanism of margin system (2)

At the end of each day, firstly the exchange's clearinghouse calculates the losses or gains of each clearing account according to the price variations (just like we explained in margin account) and determines the requirement of clearing margin (due to the number of contracts outstanding). And secondly, the clearinghouse passes all the information to its clearing member who is also the broker of the investor. And then the broker calculates the balance of each investor's margin account deciding whether there is a need to send a margin call. In this way, it greatly improves the effectiveness of clearing and meanwhile guarantees the performance of the parties to each transaction.

## 5. Trading Oil Futures Contract on NYMEX<sup>33 34 35</sup>

In this chapter, we will explore how to trade crude oil futures contract on NYMEX in detail including some of the transaction terms, the meaning of different prices on price board and so on. Besides, we will take a brief look at two trading strategies on oil: hedging and speculating.

### 5.1 Trading terms

In futures trade, there are series of terms. If one wants to engage in this business, it is very important for it to understand them.

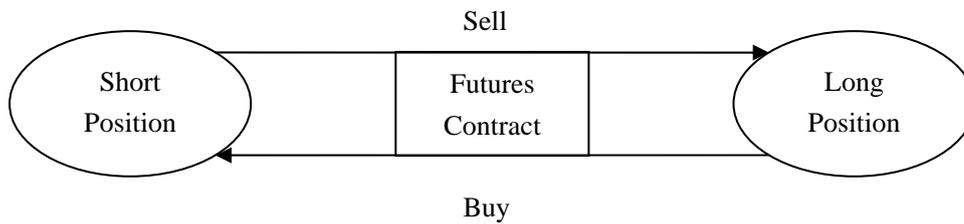
#### Position

If one buys 10 futures contracts, we say he/ she is holding 10 long positions of futures contracts. If one sells 10 futures contract, we say that he/she is holding 10 short positions. In each traded contract, there must be two sides involved in. On one side is the investor who has taken the long position. On the other side is the investor who has taken the short position. It is easy to understand, just consider that when any transaction happens, there are a buyer and seller. Note that in futures trade, one can sell contracts without any contracts in hand before. It means that one can hold short positions no matter it had long positions or not.

Usually, when an investor bets that the futures price will go up, he/she will take long positions; and if an investor bets that the futures price will drop, he/she will take

short positions.

Graph 5.6: Short position and long position



### Offset

The vast majority of futures contracts do not lead to delivery because most traders choose to quit trades before the commodities actually delivered. We call this kind of behavior offsetting. Offsetting a position means entering into the opposite type of trade from the original one. For example, an investor takes 10 long positions of July light sweet crude oil futures contracts one day, which implies that he/she is supposed to buy 10,000 barrels crude oil in July. The next day, he wants to quit the trades he was engaged in yesterday. That is to say he has to sell the oil he promised to buy. So he takes 10 short positions of the same type of futures contracts, which implies that he/she is supposed to sell 10,000 barrels crude oil in July. Hence we may consider that the investor sells the oil he promised to buy. After that, he will have nothing to do with the 10,000 barrels crude oil because he has already sold them. He has no position in hand because his long positions have been offset by taking short positions of the same type futures contract.

### Outcry

We usually see a lot of people with orange gilets shouting and making strange gestures to each other in NYMEX's hall on television. We probably wonder what they are doing. Actually, they are futures contracts traders. And this is the way they transfer the trading information such as price and volume to each other to make a deal. The price which is given for taking long position of futures contract is called bid; while the price which is given for taking short position of futures contract is called ask. When the price is agreed by both traders who wish to take a long position and who wish to take a short position, then the contract is regarded as successfully traded.

After the computer matching system was invented, most of the trades are matched by computer rather than outcry. Later we will explain how the system works.

## 5.2 Price quotation

It is very essential for one to understand the price quotation of futures contract. Because price quotations can provide us basic information of a commodity market: Price, trading volume and so on.

We take a piece of the price quotation for light sweet crude oil futures contract traded on NYMEX on June 6, 2008 as an example to illustrate the meaning of each

column. (See Table 5.7)

Table 5.7 The price quotation of light sweet crude oil futures

	Last	Open High	Open Low	High	Low	Most Recent Settle	Change	Open Interest	Estimated Volume
<u>July 2008</u>	130.75	n/a	130.75	131.56	127.81	127.79	+2.96	326247	51217
<u>Aug 2008</u>	131.09	n/a	131.03	131.84	128.14	128.18	+2.91	137653	15124
<u>Sep 2008</u>	131.22	n/a	131.23	131.80	128.38	128.34	+2.88	116830	7229
<u>Oct 2008</u>	131.14	n/a	128.36	131.50	128.36	128.30	+2.84	52189	1768
<u>Nov 2008</u>	128.91	n/a	128.43	128.91	128.26	128.21	+0.70	33065	1210
<u>Dec 2008</u>	130.85	n/a	128.33	131.55	128.00	128.10	+2.75	193241	3676
<u>Jan 2009</u>	131.07	n/a	131.13	131.37	130.99	127.99	+3.08	30907	182
<u>Feb 2009</u>	n/a	n/a	n/a	n/a	n/a	127.85	0	13793	53
<u>Mar 2009</u>	n/a	n/a	n/a	n/a	n/a	127.71	0	13576	17
<u>April 2009</u>	n/a	n/a	n/a	n/a	n/a	127.56	0	7951	7
<u>May 2009</u>	n/a	n/a	n/a	n/a	n/a	127.40	0	15624	2
<u>June 2009</u>	n/a	n/a	n/a	n/a	n/a	127.23	0	37280	325
<u>July 2009</u>	n/a	n/a	n/a	n/a	n/a	127.03	0	13191	0
<u>Aug 2009</u>	n/a	n/a	n/a	n/a	n/a	126.84	0	6877	0
<u>Sep 2009</u>	n/a	n/a	n/a	n/a	n/a	126.65	0	10005	0
<u>Oct 2009</u>	n/a	n/a	n/a	n/a	n/a	126.46	0	6034	0
<u>Nov 2009</u>	n/a	n/a	n/a	n/a	n/a	126.31	0	4718	0
<u>Dec 2009</u>	128.49	n/a	126.70	129.00	126.70	126.20	+2.29	97588	1359

Source: [www.nymex.com](http://www.nymex.com)

The first column on the left is the list of the types of light sweet crude oil futures contracts can be traded on NYMEX. We know that in the current year and the next five years, this contract delivered every month. And from the sixth to the ninth year, it is only delivered on June and December.

### **Last**

The numbers in the column titled “Last” stands for the latest price. If the price quotation is about the previous days, the number on “last” volume is the price of the last trade before the close of whole-day trading of that day. If the price quotation is about the current day, the price reflects the price of the latest trade when this quotation is published. And it will soon vary with the deals of new trades.

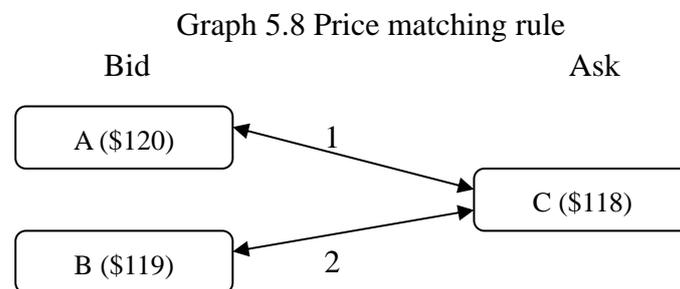
### **“Open High” and “Open Low”**

The third and fourth columns are referring to the opening price. The opening price is representative of the prices at which contracts were trading immediately after the

opening bell<sup>①</sup>. It is determined within five minutes before the opening of market. Traders convey the price information including at which price they are willing to buy (i.e. Bid price) or to sell (i.e. Ask price) futures contracts in the first four minutes. In the last minute, the computer matches the prices through a specific rule. The last matching price will be published on the price quotation as an opening price.

Ask prices and Bid prices are matched according to the following 3 principles<sup>36</sup>: Firstly, a bid price can be matched to a ask price only if the bid price is higher than the ask price. For instance, a trader is willing to buy a crude oil futures contract at the price of \$120 per barrel; meanwhile, another trader wish to sell the same type futures contract at the price of \$119 per barrel. Then their prices can be matched—that is to say the trade between them can happen. If the bid price is \$119 per barrel and the ask price is \$120 per barrel, then the two prices can not be matched because the bid price is lower than the ask price. No one would like to sell commodities lower than its selling price. The second principle is that, higher bid price and lower ask price will be matched first. That is to say the investor who gives higher purchasing price or lower selling price can prior to trade.

For example, in graph 5.3, investor A wishes to buy certain numbers of crude oil futures contracts at the price of \$120 per barrel; B wishes to buy the same type of futures contracts at the price of \$ 119 per barrel; C is willing to sell the same type of futures contracts respectively at the price of \$118 per barrel. The matching order will be like this:



First, the matching system will match A and C because A’s bid price is higher than B’s. After that, if C has some more futures to sell, he will be matched with B. If C sells the exact numbers of futures contracts that A wishes to buy, then B can not purchase from C any more.

Similarly, one who gives lower ask price can get the priority to trade.

The third principle is that investors who trade with larger amount of commodity can prior to trade. That is to say their prices can be first matched. For example, investor A wants to take 10 positions of crude oil futures contracts at the price of \$120 per barrel. Investor B wants to take 20 positions of the same type of futures contracts also at the price of \$120 per barrel. Although both of them would like to buy futures contracts at the price of \$120 per barrel, B wants to buy more positions than A does, so B will be matched to an investor who take short positions prior to A.

Here is an example in detail how buyers and sellers are matched and how the

<sup>①</sup> The signal that trades begin.

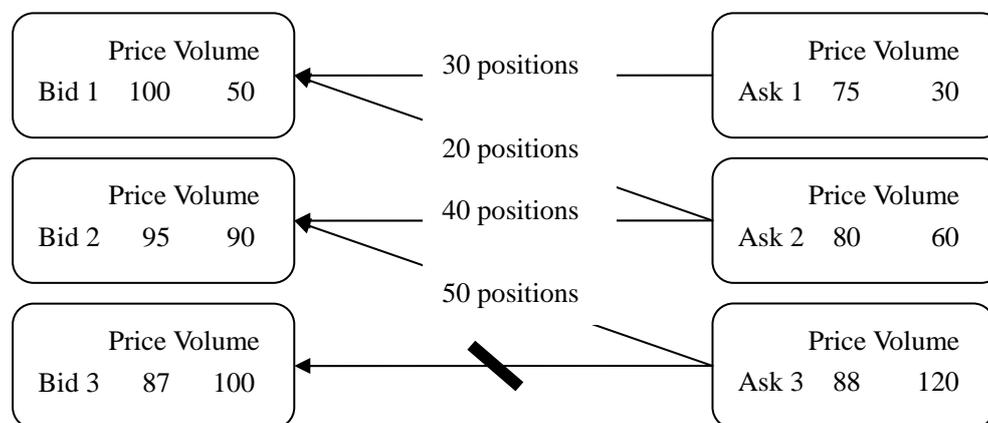
opening price is determined. Let's assume that there are 8 investors in all who give their price information to the exchange before trades start. Table 5.4 lists all the bid prices, ask prices and the amount of commodity they want trade.

Table 5.9: Lists of bid and ask prices

Order	Bid		Ask	
	Price	Position	Price	Position
1	100	50	75	30
2	95	90	80	60
3	87	100	88	120
4	80	150	95	150

The matching procedure is as following:

Graph5.10: A detailed prices matching example



Bid1 gives the highest price to buy. And Ask 1 sells futures at the lowest price. So bid 1 and ask 1 will be matched first. But Bid 1 can get enough positions from Ask 1 only. So bid 1 will be matched with ask 2 getting 20 positions from it.

After that, bid 2 will be matched with ask 2. Because ask 2 doesn't have enough futures contracts that bid 2 wants to buy. So bid 2 will be matched with ask 3 getting the rest 50 positions.

In virtue of bid 3' price is lower than all the ask prices, it can not be matched with any seller. Thus the trade between bid 2 and ask 3 is the last trade before the opening bell. And their transaction price will be accounted the opening price.

If the opening price breaks a historical high level, it will be recorded "open high". If it doesn't, the opening price will be recorded "open low".

If the highest price in this matching, for example 100 in the above case is the highest pricing in the opening during the contract's lifetime. Then it will be recorded as "open high". The last matched price before the opening of trading floor, such as 88 in the above case will be recorded as "open low".

Those declarations which have not been matched such as Bid3, Bid4, Ask3 and Ask4 will be traded through open outcry auction after the opening of trading floor.

### **High and Low Price**

It is respectively the highest price and the lowest price traded during a day. For example, on 6<sup>th</sup>, June, 2008, the August 2008 light sweet crude oil futures contracts were traded between 131.84 dollars per barrel and 128.14 dollars per barrel.

### **Most Recent Settle**

The seventh number is the settlement price. It is an average of trading prices during the last minutes of trading in futures exchange.

The settlement price is very important, because it is used for calculating daily gains and losses as well as margin requirements. For example, in the case we mentioned in page 21, the price \$119 per barrel we used to calculate the profit in the investor's margin account is a settlement price.

### **Open Interest and Volume of Trading**

The ninth and the final column show the open interest and the trading volume for each type of contract on the current day. The open interest is the number of long positions or, equivalently, the number of short positions (once there is a long position, there is a short position) which have not been offset. For example, by the time the 6<sup>th</sup> June's price quotation was published (see Table 5.2), there are 326247 of July 2008 light sweet crude oil futures contracts are outstanding. The open interest reflects investors' interest to the futures contract. If the number of open interest sharply increases, it regarded as a supportive of the underlying price trend.

The trading volume is referring to the contracts traded over the day. Sometimes it is larger than the open interest at the end of day, indicating that there are a large number of day trades. It can provide useful information that investor can factor into decision-making process by analyzing both open interest and trading volume figures through some technical analysis system.

## **5.3 Types of Traders<sup>1</sup>**

The derivatives market can't go so successful without the different types of traders. Their existences ensure the liquidity of futures market—there is always easy to find out the suitable persons to make contracts with. The market anticipators are classified into three types according to their aims of trading: hedgers, speculators and arbitrageurs. Let's take a look at what are the characteristics of these three types anticipators respectively.

### **5.3.1 Hedger**

Hedger is defined as the person or party who wants to use futures to reduce the risk they may face in an unexpected market. Market is usually influenced by lots of factors, such as political issues or even natural disasters. The price swing can always reduce people's profits even destroy their business. That's why many businessmen sell their

products in advance. They are willing to lock in a predictable price to at least cover their costs, even if it means giving up the opportunity to make more money if prices rise.

Hedging is the initial and the main function of futures trades. It is especially important for crude oil trade. Because its price is very volatile and it is traded with greatest amount in commodity trading. For example, each \$1 per barrel change in the price of oil, the Alaska's annual royalty and production tax revenue will rise or fall by about \$65 million.<sup>28</sup> There are varieties of strategies on how to use oil futures to hedge. We will discuss it in the next section.

### 5.3.2 Speculator

A speculator is the kind of person or party who uses futures or other derivatives to bet on the future direction of a market with the purpose of gaining profit from it. Unlike hedgers who are afraid of being exposed to adverse movements in price and trying to avoid it, the speculators are willing to accept it. Either they are betting that the price will increase or decrease and wish to make profit from the price variance.

For example an investor buys a July light sweet crude oil future contracts on NYMEX at \$130 dollars per barrel by depositing the required initial margin of 8525 dollars. One contract involves 1,000 barrels, so it has a market value of 130,000 dollars. Assume that the next day the price increase to \$135 per barrel. The investor offsets his position and makes a profit of 5 dollars per barrel (135-130). That means a \$5000 profit from an investment of \$8525. The return on this invested capital is more than 58%. This is really attractive to speculators.

Of course, if the price drops by 5 dollars per barrel, the investor will suffer a loss of 5000 dollars. There will be only 3525 (8525-5000) dollars left in the investor's margin account.

We can see that there are a lot opportunities for investors to gain abundant profit. But there are also huge risks that investors may lose money quickly. So speculators bet prices trends by exposing to risk and wish to gain profit. They are the party on the opposite side of the contract to hedgers. They buy or sell contracts frequently, to a great extent enhancing the liquidity of futures market.

All commodities can be manipulated by speculation, especially oil. That is because, firstly, oil is vulnerable to supply disruptions.<sup>37</sup> The outputs are easily interrupted by border wars or workers strikes. And secondly, oil is highly opaque. Only official agencies know how big a buffer we have against a supply disruption.<sup>37</sup> When the U.S. Department of Energy announces that there is a decline in U.S. oil inventories, oil's market prices are driven up sharply.

So oil is highly attractive by speculators who gain profit by betting price trend. However, bet themselves can change price. If large numbers of speculators bet that oil price will go up next month, then the oil futures of next month will rise. And it will eventually pull up the current, spot oil. According to the OPEC's 2005 claim, the reasonable oil price should be \$45. Hence we almost pay 90 dollars of "speculative premium" because oil price has reached to \$135 per barrel currently.

### **5.3.3 Arbitrageur**

Arbitrageurs are the third important group of participants who are activating in exchange. They are the kind of persons who wish to get a riskless profit by entering into transactions in two or three exchange simultaneously. For example, the WTI crude oil is traded at the price of 110 dollars per barrel on NYMEX. At the same time it is sold at the price of 112 dollars per barrel on ICE. Then it is easy to find that one will gain a riskless profit of \$2000 ( $112 \times 1000 - 110 \times 1000$ ) dollars per contract by buying it on NYMEX and sell it on ICE when ignoring the transaction fees.

Since the profit is big and with no risk, it attracts more and more people taking part in this kind of transaction. That is to say that there will be many people who want to buy crude oil futures on NYMEX meanwhile many people who want to sell the same type of futures on ICE. According to the law of supply and demand in economics, when the demand of a commodity excesses to the supply in a market, it will cause the price of this commodity rises. Similarly, when the supply is surplus to demand, that will make the price drop. Thereby, we can see that the price of the light sweet crude oil will increase on NYMEX and decrease on ICE. Very soon, the two prices will become equivalent considering the factor of current exchange rate. The arbitrage opportunities disappear.

Although the chance of arbitraging always won't last long, they can be observed by a small group of people who are so experienced and sensitive to the financial market. Thus they become a stable party of traders on exchange

## **6 Oil Hedging Strategy**

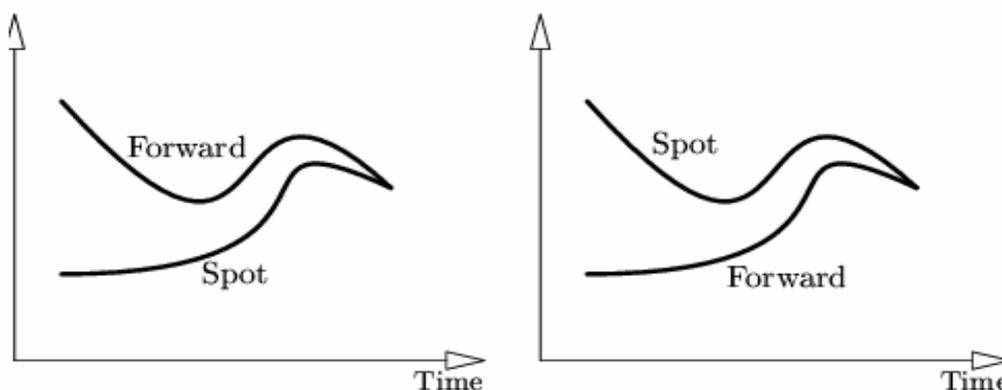
When the futures market was firstly founded, like we discussed above, it meant to help the farmers avoid price fluctuation. That is to hedge price risk. Hence hedge is the fundamental function of all futures market including crude oil futures market. So in this section we will explore the principle as well as some hedging strategies on oil futures market in details.

### **6.1 Why oil futures can hedge?**

Spot (cash) prices are the prices for which the commodity is sold at the various market locations at present. The futures price reflects the current market opinion of the commodity's value at some time in the future. Because there are large numbers of oil companies actively trading futures contracts, the prices have been regarded as standard by which to value cash market contracts. Economists point to this market activity as a way to "discover" the price of a commodity. So as the delivery month is getting close, the cash prices and futures prices are moving in tandem. This is known

as “convergence”. Usually, the futures price will be approximately equal to the present cash price plus storage fee or transportation fee from the present to the delivery month. These costs are known as normal premium of futures over cash. Even though the premium over the cash price may be large or small because the cash and futures prices fluctuate independently, any premium the futures have had will disappear over time.<sup>38</sup> A futures contract becomes a spot contract when nearing expiration.

We also can explain convergence from the point of arbitrage. For example, when the futures contract’s price is much higher than the spot price when reaching the delivery month, then one may find that it is profitable to buy the commodity in spot market and sell it on futures market. This is known as Spot-Futures arbitrage. With more and more people purchase commodity in spot market, the price will go up. And with more and more commodity sold on futures market, the futures price will decrease. Thus the difference between spot price and futures price will getting less and finally disappear. And it is similar when the spot price is higher than the futures price.



Graph 6.1: The convergence of futures and spot price

Source: [http://www.theponytail.net/DOL/DOLnode20.htm#Fg: Spot-Fwd\\_conv](http://www.theponytail.net/DOL/DOLnode20.htm#Fg: Spot-Fwd_conv)

So, due to the convergence relationship between futures price and spot price, the risk of an adverse change in this relationship (known as basis risk) is generally much less than the risk of that of unhedged. Thus hedge will possible be effective. And the more participants in the market, the more precisely that the futures price will reflect value of the commodity.<sup>39</sup>

## 6.2 Hedging strategy<sup>40 41 42</sup>

When a company or individual chooses to use oil futures to hedge a risk, its objective is to take a position that can neutralizes the risk. For example, a WTI crude oil producer knows that it will gain \$100,000 for each 1 cent increase in the price of WTI crude oil over the next, let’s say 3 three months. And it also knows that it will lose \$100,000 for each 1 cent decrease in the price of WTI crude oil during the same period. To neutralize this risk by futures contract, it means that futures positions should result in a loss of \$100,000 for each 1 cent increase in the price of WTI crude

oil over the next month and a profit of \$100,000 for each 1 cent decrease in the price. That is to say, when price goes down, the profit on futures market can offset company's loss on spot market; when price goes up, the profit on spot market can offset the loss on futures market.

There are two types of hedge: short hedge and long hedge, or they can be called as seller's hedge and buyer's hedge.

### **6.2.1 Short hedge**

A short hedge is referring to a short position in futures contracts. It is widely used by parties who want to sell commodity on spot market, such as oil producer. Because once the commodity is taken along the supply chain, no matter from a barge or refinery to consumer, its value is exposed to price risk until it is sold or used. By using short hedges, the sellers can lock the selling price to a profitable level.

For example, on May 1<sup>st</sup>, an oil producer has signed a contract to sell 100,000 barrels WTI crude oil in September 15. And the price will tie to the spot price on September 15<sup>th</sup>. Assume that the spot price of WTI on May 1<sup>st</sup> is 120 dollars per barrel and the September light sweet crude oil futures contract on NYMEX is 122 dollars per barrel. The producer can hedge the price risk by shorting 100 futures contracts (each contract represents 1,000 barrels) and lock the selling price to 122 dollars per barrel.

If the spot price of WTI crude oil is \$119 per barrel on September 15<sup>th</sup>, the company can realize 11,900,000 dollars by selling crude oil it promised. Because September is the delivery month of futures contracts, the contracts' price should be very close to the spot price (see discussion in 7.1). So the company can gain profit by offsetting its futures positions. And the profit is approximately \$3 per barrel (120-119). Thus the total amount of money the company receives is 12,200,000 dollars. That is \$122 per barrel.

If the spot price of WTI crude oil is increases to \$123 per barrel rather than drops to \$119 per barrel on September 15<sup>th</sup>, the company can realize 12,300,000 dollars by selling crude oil on spot market. But the company will suffer a loss of \$1(123-122) per barrel by offsetting its futures positions on futures market. So, the total money the realized from futures market and spot market is still 12,200,000 dollars or \$122 per barrel.

From the example above, we see that no matter the price decreases or increases, the company still can sell its crude oil at a locked price. It completely hedges the price risk.

### **6.2.2 Long hedge**

A long hedge is referring to taking long positions in futures contracts. It is used by those who know they are going to purchase certain assets in the future and want to lock the price at present, such as oil refiners or distributors. They are afraid of

suffering losses due to the increase of crude oil price when purchasing.

For example, on 1<sup>st</sup> June, the Gulf price of WTI crude oil is \$120 per barrel. The refiner knows that it will purchase 100,000 barrels of crude oil on August 15<sup>th</sup>. Suppose that the price of August light sweet crude oil futures contract is \$ 122 on NYMEX. The refiner takes 10 long positions of the futures contracts to hedge the price risk. By this strategy, he can lock in a price of \$122 dollars per barrel. Let's take a look how it happens.

If the spot price increases from 120 dollars to 125 dollars on August 15<sup>th</sup>, it will cost 12,500,000 ( $125 \times 100,000$ ) dollars for the refiner to buy 100,000 barrels of crude oil. We know that futures price will be close to the spot price when approaching to the delivery month. So the August light sweet crude oil futures contract's price should be about \$125 per barrel. The refiner can gain a profit of  $3(125-122)$  dollars per barrel by offsetting his futures positions. Hence the total cost can be reduced to \$122 ( $125-3$ ) per barrel.

If the WTI crude oil spot price decreases to 118 dollars per barrel on August 15<sup>th</sup>, the refiner can buy 100,000 barrels oil with 11,800,000 dollars. However, he will suffer a loss of 400,000 [ $(122-118) \times 100,000$ ] dollars by offsetting his futures positions. Taking spot market and futures market into consideration, the cost of purchasing WTI crude oil is \$122 per barrel.

## 7. Summary

Oil is regarded as the “blood of modern industry”—it is the most widely used fuel and also the raw material of thousands of chemical products. Oil locates unevenly around the world. A large part of it was buried under the ground of Middle East. The rest mainly distributes in Latin America, Africa and Eastern Europe; Very little oil was proven in North America, Western Europe and Asia-Pacific. (see graph 1.3) However, North America, Western Europe and Asia are the top three oil consumption areas. This contradict between oil consumption areas are not oil producing areas makes oil trade is a necessity. And oil trade becomes the biggest commodity trade in the world.

At beginning, oil trade was monopolized by great multinational oil companies such as Mobile, BP. After the establishment of the OPEC in 1960, the OPEC began to control oil supply. And the OPEC also established an “official price” to protect their profits. There were two “oil crises” during 1970's—oil price increased sharply, which caused serious impact on world's economy. After that, the world oil spot markets were developed because the prices on spot markets could better reflect the supply and demand situation of oil. In 1985, Britain firstly announced that it will tie the oil trading price to spot markets rather than the fixed prices in long contracts.<sup>8</sup> With more and more countries or companies willing to trade oil on spot market, oil began to behave like the other commodities whose prices going up and down by the influence of market forces. Hence, there is a very need to bring out oil futures.

In 1978, the first successful oil futures—heating oil futures was initiated in New

York Mercantile Exchange. A few years later, the world's famous WTI crude oil futures and Brent crude oil futures were respectively initiated in NYMEX, 1983 and in ICE, 1988. Currently, they are the top two commodity futures (ranked by trading volume) in the world, and play as price indicator to oil products around the world.

Compared to oil forward contract, oil futures contract is a kind of standard contract. It gives specifications on the quality of the underlying oil, delivery months, and delivery locations and so on. Oil futures are only traded on exchange. And like other commodities, traders of oil futures are divided into three types: hedgers, speculators and arbitrageurs. Hedgers are those who want to use futures to hedge price risks on spot market. Generally speaking, there are two kinds of hedging strategies: short hedge and long hedge. Whether to use long hedge or short hedge will depend on the hedger's position on spot market—will he/she sell or buy commodities on spot market. Speculators are those who want to gain profit through the price difference between purchasing price and selling price of oil futures contract. Arbitrageurs are also the type of traders who want to gain profit from futures market. But unlike speculators who are wishing to gain profit from a positive price trend, arbitrageurs are gaining profit from variance of price difference between two related commodity futures contracts. To sum up, hedge is the main function of futures market; but the existence of speculators and arbitrageurs increase the markets' liquidity.

Recently, world crude oil price has reached to its zenith in history almost day after day. Until now, the highest price of light sweet crude oil futures contracts on NYMEX has reached to more than \$137 per barrel, more than doubled last year. This is not only a result from the OPEC's "limited output" policy, but also the aftermath to numerous economic factors such as the weakness of U.S. dollars and the frequent speculative activities from hedge funds (see footnote 7 page 11). It is said that the international speculative activities have an affect of \$90 per barrel on crude oil prices.<sup>43</sup> Therefore, there are some arguments that the existence of futures makes oil price more volatile<sup>37</sup>. Anyhow, futures contracts trade in standardized units in a highly visible, extremely competitive, continuous open auction. In this way, oil futures can function as an efficient price discovery tool, giving an accurate picture of the future oil market.

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