HEDGING WITH DERIVATIVES IN THE OIL INDUSTRY

by

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ABSTRACT

This purpose of this study is to examine the derivative use by 15 US-Oil producing companies. This study tries to determine whether the release of SFAS No 133/138 by the federal accounting standard Board has affected hedging product choice and strategies of oil producing companies. In addition, this study attempt to evaluate the connection between firm characteristics and risk management strategies in order to determine which type of firm characteristic plays a role in the oil producing companies risk management decisions. This study verifies that SFAS 133/138 does not affect financial disclosure, derivative hedging strategies for oil companies. Moreover, some Firm characteristics play a main role in the decision to engage in derivatives.

Keywords: oil derivatives; oil swaps; oil futures; oil price risk; oil currency risk; oil hedging.

To my Dad and Mom. Words can never express my gratitude to you.

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1 1 INTRODUCTION AND BACKGROUND

1.1 Literature review of the oil industry

The trading environment of the oil market is inherently unstable, with geology, geopolitics, economics, law, taxation, finance, technology, and environmental concerns having a strong impact at anytime on the evolution of the market structure. Some of the main risk factors of the oil industry, such as geological risk, can be reduced by using modern techniques and the latest technologies, but can never be completely managed. Historically, this encouraged risk managers of the oil industry to focus on the relationship between time and price. It takes several years and huge investments to produce crude oil from an oil field. In addition, it takes several weeks and sound logistics to deliver the extracted oil to the end consumers. This forms the backdrop to the growth in risk management of the oil industry.

The fundamental pricing environment for oil transactions has undergone major changes since the large jumps of the 1970's. The shift in production assets ownership from major oil companies to producing countries and national companies, through different forms of nationalization, marked the beginning of an open market. For most companies, this meant that they could no longer simply transfer risk and added value vertically along different steps of the oil supply.

The supply and demand equilibrium in the oil market has been strongly influenced by the physical oil market. Oil companies and oil importing countries often consider the oil market as a kind of dynamic counterweight to the dominance of producing countries or more precisely, Organization of the petroleum producing countries (OPEC). As the oil market developed, it transformed from a primarily physical market into a financial market. This has attracted many participants, such as banks and hedge funds managers. In particular, retail and institutional investors hoping to increase their yield through price movements, or reduce their credit exposure by using oil as collateral, has dramatically increased their presence in the futures market.

Since oil is a non-standard commodity, the industry has chosen a small number of reference or market grades of crude oil to be the physical basis of a much more sophisticated financial market that involves derivatives instruments such as forwards and futures contracts. A large volume of activity is thus concentrated through a small number of the trading instruments to deal with the price risk. This price differential has shaped the pricing of different grades, locations, and delivery periods. Although, their physical base is rather small compared to the overall production, free oil market has become a main factor in the pricing mechanism of the short to medium term crude oil and refined products. Consequently, the free oil market has played a significant role as seen by events including the Gulf crisis of 1990 and the price drop of 1998.

Nowadays, the world consumption of oil exceeds $500 billion annually. In addition, crude oil is the most active trading commodity that accounts for 10% of the total world trade. The oil industry stems its importance mainly from the crucial and strategic role it plays in the economies of oil exporting countries as well as oil consuming countries. In oil exporting countries, oil prices drive revenue by a large number that could exceed

20% of the domestic GDP. On the other hand, the cost of oil imports for oil consuming countries has a strong impact on the growth of the economy. Energy price shocks have often been cited as causing adverse macroeconomic impacts on aggregate output and employment in countries across the world.

1.2 History of oil prices (1985 -2006)

In 1947, crude oil was priced around $2.27US per barrel. Then it exceeded $12.00 US per barrel as a result of war or conflicts in the Middle East in 1973. The events that caused a major price shock during the last century were the 1973 Arab oil embargo, the Iraq-Iran conflict of 1979, and the 1990 invasion of Kuwait.

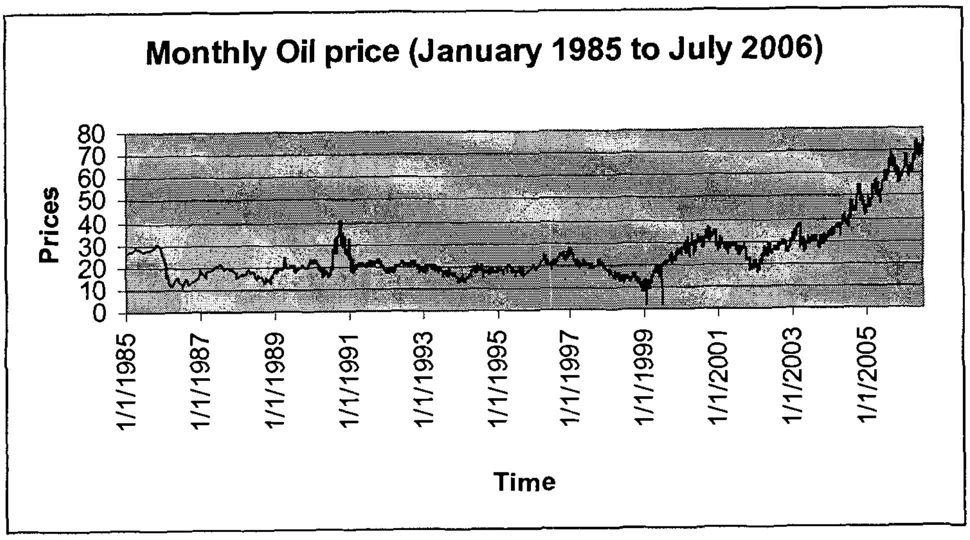
Oil prices stayed in the range of $2.50 US to $3 US from 1947 to 1972. Then, these oil prices jumped from $3 US in 1972 to $12 US in 1973. This substantial rise was due to the Yum Kipper war in the Middle East. This was followed by the Iraq-Iran war that caused oil prices to double, from $14 US per barrel in 1978 to $35 US per barrel in 1981. However, the ensuing world recession and development of alternative energy resources led to a decrease in demand and falling prices for most of the 1980's. Efforts by OPEC to set production quotas, as an attempt to shore up prices, were largely unsuccessful and were met by nations routinely violating these limits. As an example, in 1986, Saudi Arabia increased production by 2 MMBPD to 5 MMBPD, causing oil prices to plummet below $10 US per barrel.

In 1991, due to the Iraqi invasion of Kuwait, oil prices surged. However, it retreated in the face of an US-led military resolution and the market saw increased supply by other nations such as Saudi Arabia. Recession in the US saw a price decline until 1994 when inflation adjusted prices hit their lowest level since 1973. Subsequently, a strong US economy and growth in Asia led to an increase in the demand of world petroleum. for example, demand grew 2.8% in 1995 and 2.2% in 1996. This caused the price of oil to increase by $6US per barrel over the course of that year. Despite Iraq's re-entry into the oil world market in December 1996, the price recovery continued well into 1997, until the sharp downturn by the Asian economic crisis occurred.

Crude oil prices on the nearest futures chart in 2005 extended the rally that started in 2002 and posted a record high of $70.85 US in early September of 2005. Oil prices rallied in the first half of the year based on strong demand, the second Iraq war, flat production, and speculative buying. Crude oil demand in 2005 remained very strong, due in large part to torrid GDP growth in China, and reached a record high of 86.2 million barrels per day by the end of 2005.

Hurricane Katrina hit the Gulf of Mexico on August 29th, 2005. Consequently, oil prices surged after the devastation caused by Katrina, but this turned out to be the year's peak as oil prices dropped off sharply in late September through December. Oil prices were able to fall in late 2005, despite the shut down of crude oil production in the Gulf of Mexico because of a drop in demand and a large increase in petroleum supply. Crude oil prices stabilized in December 2005 and then started to rally up in January 2006 as concern grew regarding reduced Nigerian oil production due to rebel attacks and the increasingly tense standoff with Iran about its nuclear research intention.

Figure 1 History of oil prices



2 THE MAIN FOUR CLASSIFICATIONS OF CRUDE OIL

The oil industry classifies crude oil by the location of its origin (e.g. West Texas Intermediate or Brent) and often by its relative weight (light, intermediate, or heavy). Refiners may also refer to it as "sweet", which means it contains relatively little sulfur, or as sour, which means it contains a substantial amount of sulfur and requires more specifications to meet current product specifications. The four main oil reference are:

1) West Texas Intermediate (WTI): also known as Texas sweet light. This is the crude that is used as a benchmark in oil pricing and the underlying commodity of New York Mercantile Exchange's Oil futures contract.

2) Brent crude: Comprising of 15 oils, from fields in the Brent, and ninian systems in the east Shetland basin of North Sea. It is a light and sweet crude oil, but not as light and sweet as WTI.

3) Dubai: used as a benchmark for Middle East oil flowing to the Asia Pacific Region.

4) OPEC Basket: It reflects the characteristics of the oil produced by OPEC members. The OPEC Reference Basket (ORB) is made up of the following: Saharan Blend (Algeria), Minas (Indonesia), Iran Heavy (Islamic Republic of Iran), Basra Light (Iraq), Kuwait Export (Kuwait), Es Sider (Libya), Bonny Light (Nigeria), Qatar Marine (Qatar), Arab Light (Saudi Arabia), Murban (UAE) and BCF 17 (Venezuela).

References to oil prices are usually to the spot price of either WTI/Light Crude as traded on New York Mercantile Exchange (NYMEX) for delivery in Cushing, Oklahoma; or to the price of Brent as traded on the Intercontinental Exchange (ICE) for delivery at Sullom

Voe. Based on 2005 price movements, WTI is about $1.6 more than Brent, $5.13 more than OPEC Basket. And 6.93 more than Dubai.

3 RISK MANAGEMENT

Risk managers have implemented hedging strategies using derivative instruments such as forwards, futures and options or swaps. The objectives of these strategies include protecting budgets, inventories or as a tool to project financing. These approaches have mainly focused on eliminating financial risk exposure, as opposed to increasing return. According to many studies, risk management and eliminating risk are driven by two main theory motives:

1) Maximizing shareholder's wealth
2) Maximizing marginal utility for managers

Maximizing shareholder's wealth argues that firms hedge to reduce the various costs involved with highly volatile cash flows. There are three lines of explanation associated with this theory. First, hedging reduces the expected cost of financial distress (Mayers and Smith 1982). Second, hedging may also be motivated through tax incentives. When firms face a convex tax function, hedging can help reduce expected taxes. In addition, hedging can also increase a firm's debt capacity, resulting in a greater tax advantage from greater leverage (Leland 1998). Finally, hedging can also help relieve the problem of underinvestment, when a firm may have many growth opportunities and external financing is more expensive than internally generated funds (Foot, Scharfstein, and Stein 1993). The maximizing marginal utility hypothesis states that by making risk management policy decisions along with using corporate resources, managers can diversify their personal wealth at the corporate level and/or signal their high performance on the job. According to Stulz (1984), risk-averse managers engage in hedging if their wealth and human capital are concentrated in the firm they manage and if they find the cost of hedging on their own account is higher than the cost of hedging at the firm level.

Many attempts were made to identify which theory better explains actual hedging activities based on the firm's characteristics; however, results were mixed. For example, risk management activities were found to be more prevalent in large firms than in small firms. This result contradicts the common thinking that small firms are more likely to hedge because they are more likely to experience financial distress. However, hedging seems to be driven by economies of scale, reflecting the high fixed costs of establishing risk management programs. Another report by Haushalter (2002), found a positive significant relationship between hedging and leverage, which is consistent with the theory that hedging reduces financial distress.

Overall, there is mixed support for the value maximizing theory. Mian (1996) surveys the implications and reports that the only reliable observation is that hedging firms tend to be larger. Also, Tufano (1996) examined the hedging activities on the gold industry and found no support for value maximization theory. However, he found strong evidence supporting the managerial risk aversion theory, in which mangers, who hold more stock, tend to undertake more hedging activities.

Recent researches have been examining the direct relationship between firm value and hedging. Some researchers, such as Allayannis and Weston, have supported the theory of increasing firm value with hedging. In their study, They have found that the market value

(MV) of firms using foreign currency derivatives is 5% higher on average than for the market value of nonusers. On the other hand, others like Jin and Jorion (2006), find that hedging does not seem to affect MVs for this industry. Jin and Jorion in their paper studied the hedging activities of 119 US Oil and gas producers from 1998 to 2001 and examine the relation between hedging and firm value. They examined the relation between stock return sensitivity to commodity prices and hedging. Since market recognizes the effect of hedging, they tested if the market rewards firms that hedge with higher MV's, as measured by using different definitions of Tobin's Q. Tobin Q is generally defined as the ratio of the MV to the replacement value of assets, where the latter is usually measured as the book value (BV) of assets. In addition, they used the current value of reserves both before and after extraction costs, which yields more precise estimates of the replacement value of assets. Contrary to previous research, Jin and Jorion showed that hedging has no discernible effect on firm value for oil and gas producers.

4 RISK EXPOSURES FOR OIL COMPANIES

I will outline below the risks that are integral and specific to the oil industry; however, we need to acknowledge that some oil companies have to devise strategies that take into consideration other kinds of risk that are associated with their internal operations.

1) **Commodity price risk:** for oil companies, commodity price risk is the crude oil price risk. This risk arises significantly when companies engage in contracts to sell or buy the crude oil in the future. Oil price movements can significantly affect the operation, asset value, cash flow, potential revenue and profits of oil companies. Oil price changes can be attributed to numerous factors beyond the company's control. This can include expected inflation rate, interest rate changes, strength of some major currencies, some political and economic events, demand and supply of the crude oil. Oil companies use a wide range of derivatives to mitigate unexpected price movement effects on cash flow and earnings. These instruments are aimed to secure a predictable cash flow that can assist in planning and forecasting future revenues, thus ensure that the financial commitments can be met and profitable projects can be carried out.

2) **Foreign exchange rate risk:** this is one of the most important kinds of risk exposure for oil companies. When hedging oil price risk, an exchange rate risk may be incurred, because most contracts are traded in or indexed to the US dollar. Many European end-users actually pay their energy supplies in Euros, and consequently, they become highly sensitive to any lack of correlation between currencies and between the currency market and the oil market. Most oil companies have their operations, development activities and investments across countries; therefore, they generate revenues and incur costs in different currencies. This makes cash flow from operations greatly affected by the fluctuation in foreign currency exchange rates.

3) **Interest rate risk:** this risk refers to the variability of the value of the firm resulting from interest rate changes. These fluctuations would have a strong effect on long-term debts, financing costs, cash balances and forward contract hedging. A significant prolonged decrease in interest rates could have a strong impact on the difference between the forward oil price over the current spot price, and ultimately, the realized price under new forward oil price contracts engaged by the company.

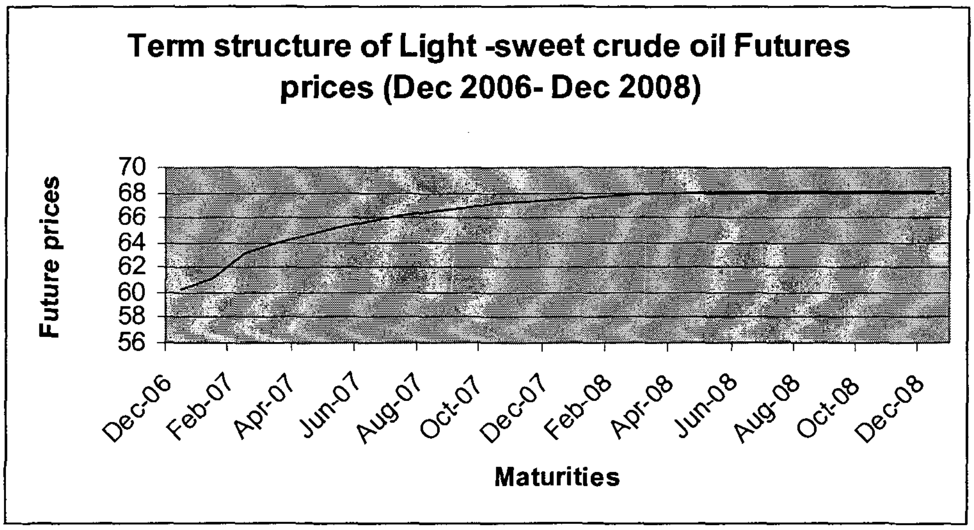
4) **Credit risk:** this is the risk that a loss will be experienced because of default by the counterpart in the derivative transaction. Also, it expresses the exposure of the forward cash flow and deferred payments to market risks. It must be considered with regard to: the risk component of the underlying index (for example, volatility, correlation, liquidity); the maturity and type of the instruments, for example, short-term versus long-term, buying versus selling, swap versus option; and the relative level of the market.

5 THE IMPACT OF SUPPLY DRIVERS

Crude oil function with supply that does not exist in money markets: production and storage. This would require consideration of the long term effects, which have to do with expected market production capacity and cost in the long run. Historical data will not show the effect that expected technology improvements (such as drawing crude oil from the ground) have on the market; however, the effect may be expressed by knowledgeable traders in determining forward prices.

The crude oil's storage limitation problem creates volatile day-to-day behavior. Another consequence of limited storage is that while spot prices exhibit high volatility, the forward prices show volatilities that decrease significantly as the forward price expiration increases. The latter volatility characteristic has to do with the fact that in the long run we expect the supply and demand to be balanced, resulting in long-term forward prices that reflect this relatively stable equilibrium price level. See the figure 2 below.

Figure 2: Term structure of oil futures



From **Figure (2)**, we can see that the future prices of crude oil went through relative considerable changes from December 2006 to almost February 2008, rising from 60.36 to 67.81. After that, futures have become more stable with changes that were relatively unsubstantial , rising from 67.92 in March 2008 to 68.08 in December 2008.

Ultimately, when discussing movements in the price of oil, it is essential to confront the issue of storage capacity. Storage limitations cause oil markets to have higher spot price volatility than is seen in money markets.

Overall, the issue of storage accounts for oil prices exhibiting a spilt personality. Oil prices are driven both by the short-term conditions of storage and by the long term conditions of future potential oil supply. Oil forward prices reflect these two drivers, resulting in short-term forward prices with very different behaviour from long-term forward prices. Short-term forwards reflect oil currently in storage; while the long-term forward prices exhibit the behavior of future potential oil - i.e. oil in the ground.(Dragana Pilipovic, Energy Risk, 1998).

6 THE IMPACT OF DEMAND DRIVERS

In the oil market, demand drivers introduce the issue of convenience yield and seasonality that have no parallel in the money market.

6.1 The convenience yield

An oil refiner is unlikely to regard a future contract on crude oil in the same way as crude oil held in inventory. The crude oil in inventory can be input to the refining process, whereas, a future contract cannot be used for this purpose. Thus, the ownership of the physical asset enables the company to keep a production process running and perhaps profit from temporary local shortages. A futures contract does not do the same. The benefits from holding the physical assets are sometimes referred to as the convenience yield provided by the commodity. If the dollar amount of storage costs is known and has a present value of U, according to John C. Hull (Options, futures, and Other derivatives) the convenience yield y is defined such that:

Table 1 The convenience yield formula

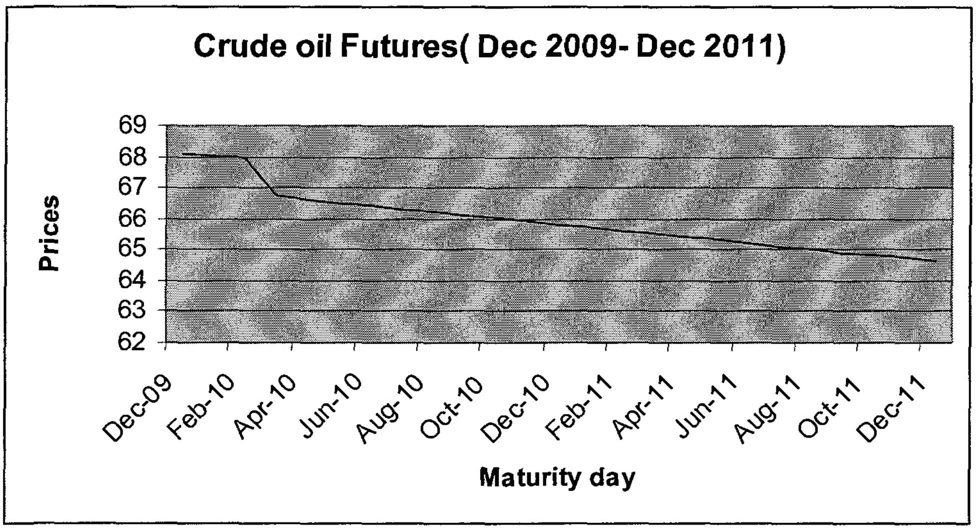
$$F_0 e^{yT} = (S_0 + U) e^{rT}$$

U = storage cost per unit
F_0 = forward price
T= time to maturity
S_0 = spot price
r= risk free interest rate

The convenience yield simply measures the extent to which the left hand side is less than the right hand side. The convenience yield reflects the market's expectation concerning the future availability of the commodity. The greater the possibility that shortages will occur, the higher the convenience yield will be. If commodity users have higher inventories, there is very little chance of shortages in the near future and the convenience yield tends to be low. On the other hand, low inventories tend to lead to a high convenience yield.

Figure(3) below shows that future prices of crude oil tend to decrease as the time to contract maturity increases using a September 1st, 2006 date. These patterns suggest that the convenience yield, y, is greater than r+U for oil on this date. In other words, the convenience yield is the net benefit minus the cost – other than financing - of holding the crude oil in inventory.

Figure 3: Crude oil futures



6.2 Seasonality

On the demand side, we have to consider the significant seasonality effects of consumption. Aggregate consumption demand creates seasonality. In the oil market, the seasonality effect on demand is evident; oil demand is influenced substantially by weather conditions that are mainly captured in seasonal patterns. As an example of this seasonality in demand, the United States consumes heating oil mostly during the winter. Hence, heating oil prices peak during winter and then drop to their annual lows in the summer. These seasonality effects can be seen and measured not only through the historical spot price data, but also by observing the forward price market.

7 DERIVATIVES USAGE IN THE OIL MARKET

Derivatives allow investors to transfer risk to others who could profit from taking the risk. The company transferring the risk achieves price certainty, but loses the opportunity to make additional profits when prices move opposite to the expected. At the same time, the company taking on the risk will lose if the counterparty's expectations are realized. Except for transaction costs, the winner's gains are equal to the loser's losses. Similar to insurance, derivatives protect against some adverse events. Because of their flexibility in dealing with price risk, derivatives have become an increasingly popular way to isolate cash earnings from price fluctuations. The most commonly used derivative contracts are forward contracts, futures contracts, options, and swaps.

Prior to 1973, oil transactions were mostly done through contract sales within an integrated system of the major oil companies. The buyer and the seller were committed to trade oil, often at a fixed price for a set of period of time, which could go as far as three years. The spot market functioned as a residual market for imbalances between oil companies, refineries and market demand. After the 1973 oil crisis, when Middle Eastern oil producing countries restricted their oil supplies, the spot market started to play a more important role. Spot prices rather than contract prices became the main indicator of the overall market condition. By 1984, the spot market accounted for 85-90% of internationally traded oil.

From the late 1980's through to the late 1990's, derivatives have proliferated across the oil industry. This financial revolution came about as a result of structural development in both the financial services sector and the oil industry.

During the 1990's, financial institutions faced shrinking profit margins and increasing over brokering of their traditional lines of business, such as interest rate swaps and currency trading. They reacted to these trends by trying to "push the envelope" of their portfolio of financial products in three dimensions: product complexity, range of instruments underlying the derivatives contracts and customer base.

Before I start explaining the different derivative contracts, it is essential to outline the two main markets in which these derivatives operate:

7.1 Exchange traded derivatives

Exchange traded crude oil derivatives include oil futures and options on oil futures. Crude oil futures contracts were first introduced on the New York cotton exchange in 1974. The initial contracts failed to attract sufficient trading volume mainly because of a period of a very low volatility. Industry participation also cited the inconvenient delivery requirement, Rotterdam, as a reason for the lack of interest. However, in the late 1970's and early 1980's futures contracts were more successfully introduced and this was mainly attributed to the successive deregulation in the energy industry, which made the prices more volatile. Crude Oil futures contracts were introduced on the New York Mercantile Exchange (NYMEX) on March 30, 1983. One contract gives the obligation of the delivery of 1,000 barrels (42,000 gallons) of light sweet crude oil at Cushing, Oklahoma, or at the seller's facility.

At any time, Contracts are traded for delivery in any of the 18 consecutive months. In addition, four long dated contracts (21, 24, 31, and 36 months) are traded. Delivery of oil can be made over the course of the delivery month. Trading volume grew from a total of 323 million barrels in 1983 to 5 million barrels per day in 1984 to 100 million barrels per day in 1990. Market participants include integrated oil companies, independent refineries and oil producers, traders, and financial institutions such as banks and securities firms. Another reason that played a role in the success of this market is the small size of the contracts. This allows broader participation and a delivery point that is convenient and that can handle large quantities of oil.

7.2 OTC derivatives

Over the counter (OTC) contracts are privately negotiated contracts that are offered internationally by dealers directly to end users. Since each transaction involves its own negotiation, OTC derivatives were generally customized to the needs of the contracting parties. In recent years, the market for OTC has grown substantially as a response to the demand for financial products for managing current and future risks, for taking market risk positions, and for exploiting inefficiencies between markets.

Despite the fact that end users can access the OTC directly, in most cases, they avoid doing that for three main reasons:

1) because of the lack of required infrastructure (Trading personnel, management control)

2) because of a desire to minimize calls on capital to meet margin requirements

3) and finally, the need to customize the contracts to their needs.

The OTC market typically settles in cash rather than the physical delivery of the asset, which makes this choice a more cost effective investment. The OTC in the oil industry offers a variety of products, including forwards, swaps and options. Primary dealers include major crude oil traders such as British Petroleum and hedge oil, and banks and security firms such as Chase, Bankers, Morgan Stanley, and Banque Paribas.

7.3 Oil financial exchange markets

The two most well-known financial markets that trades oil futures and options contracts are, the New York Mercantile Exchange (NYMEX) and the International Petroleum Exchange(IPE) (also Currently known as ICE Futures). The New York Mercantile Exchange (NYMEX) is the world's largest physical commodity futures exchange, located in New York City. Its two principal divisions are the New York Mercantile Exchange and the New York Commodities Exchange (COMEX) which were once independent companies but are now merged. The international petroleum exchange (IPE), based in London, is one of the world's largest energy futures and options exchanges. Brent Crude is a world benchmark for oil prices, but the exchange also handles futures contracts and options on Oil gas, natural gas, electricity. Some of the futures are settled in cash , others are settled by physical delivery. For example, the Brent crude oil futures traded on the ICE (Formerly Known as IPE) has cash settlement based on the Brent index price, whereas, the light sweet crude oil futures traded on NYMEX requires physical delivery. In both cases, the amount of oil underlying one contract is 1000 barrels. (See appendix 5 & 6 for products specifications)

7.4 Forward contracts

A forward contract is an agreement made between two parties to buy (sell) a specified quality and quantity of a goods at an agreed date in the future at a fixed price or at a price determined by formula at the time of delivery to the location specified in the contract.

Forward contracts must specify delivery locations, the length of delivery period, delivery conditions, properties of the delivered commodity, payment dates, etc. A long position is an obligation to purchase the asset, and a short position is an obligation to sell the asset. The terms of the forward contracts are generally customized to the needs of the contracting parties. Typically, forward contracts are an OTC contract and settled at maturity only.

In any market, a forward curve comprises a collection of prices, transacted today, for the delivery of the asset in question at some future point. When these prices are sorted by maturity and plotted on a graph, they map out the term structure of the forward price of the asset: the forward price curve.

There are some key facts about forward curves in financial markets. These facts are essential for developing pricing models:

1) In financial markets, the relation between spot and forward prices can be established through the no-arbitrage argument. That is, the forward price should not be greater than the sum of the spot price plus interest cost, plus storage cost. Otherwise, a risk-less profit can be made by selling forward contracts, borrowing funds, buying oil in the spot market, store it to maturity and then deliver it.
2) Financial derivatives products can be priced off of the forward curve, called risk neutral evolution. This property allows for the existence of a perfect hedging strategy.
3) An abundance of historical data in financial markets makes it possible to establish reliable and stable statistical properties of forward prices.
4) The presence of forward markets directly trading the distribution of the forward prices (i.e. options markets) allows risk managers to replicate and manage a wide variety of derivatives products.

Typically, prices are quoted for a par quality of crude oil. Discounts or premiums based on quality bases are added to par to reflect differences in quality from par. Similarly, premiums or discounts are added to reflect differences in the delivery point from the standpoint.

At inception, the price of the forward contract is chosen so that the value is zero. However, over the time of contract, the value of the contract can be negative or positive, depending on changes in the spot prices, interest rates, and supply and demand conditions.

7.5 Futures contract

Futures contract can be defined as a contract that obligates the holder to buy or sell an asset at a predetermined delivery price during a specified future time period. The main difference to a forward contract is that futures are market to market, that is, settled daily based on its change in value, usually at the end of the day. It is exchange traded and its terms are standardized. Unlike a forward contract, buyers and sellers of futures contracts deal with an exchange, not with each other. For example, a producer wanting to sell crude oil in December 2006 can sell a futures contract for 1,000 barrels of West Texas Intermediate (WTI) to the NYMEX, and a refinery can buy a December 2006 oil future from the exchange. The December futures price is the one that causes offers to sell to equal bids to buy i.e., the demand for futures equals the supply. The December futures price is public, same as the volume of trade. If the buyer of a December futures finds later that he does not need the oil, he can get out of the contract by selling a December oil future at the prevailing price. Since he has both bought and sold a December oil future, he has met his obligations to the exchange by netting them out.

Table 2 Futures example

Date	WTI Spot per barrel	December future per barrel	Current activity	Cash in(out)
January	$22	$ 26	Refiner "buys" 10 contracts for 1,000 barrels each and pays the initial margin	($22,000)
March	$20	$24	Mark to market: (24 - 26) x 10,000	($20,000)
September	$20	$27	Mark to market: (27 - 24) x 10,000	$30,000
October	$27	$33	Mark to market: (33 - 27) x 10,000	$60,000
November	$33	$33	Refiner either: (a) buys oil, or (b) "sells" the contracts. Initial margin is refunded	($330,000) $22,000

The above table illustrates how futures contracts can be used both to fix a price in advance and to guarantee performance. Suppose in January a refiner can make a sure profit by acquiring 10,000 barrels of WTI crude oil in December at the current December futures price of $26 per barrel. One way he could guarantee the December price would be to "buy" 10 WTI December contracts. The refiner pays nothing for the futures contracts but has to make a good-faith deposit, called initial margin with his broker. NYMEX currently requires an initial margin of $2,200 per contract. During the year the December futures price will change in response to new information about the demand and supply of crude oil.

In the example, the December price remains constant until May, when it falls to $24 per barrel. At that point, the exchange pays those who sold December futures contracts and collects from those who bought them. The money comes from the margin accounts of the refiner and other buyers. The broker then issues a "margin call," requiring the refiner to restore his margin account by adding $20,000 to it.

This "marking to market" is done every day and may be done several times during a single day. Brokers close out parties that are unable to pay (make their margin calls) by selling their clients' futures contracts. Usually, the initial margin is enough to cover a defaulting party's losses. If not, the broker covers the loss. If the broker cannot, the exchange does. Following settlement after the first change in the December futures price, the process is started anew, but with the current price of the December future used as the basis for calculating gains and losses.

In this example, let suppose that In September, the December futures price increases to $27 per barrel, the refiner's contract is marked to market, and he receives $30,000 from the exchange. In October, the price increases again to $33 per barrel, and the refiner receives an additional $60,000. By the end of November, the WTI spot price and the December futures price are necessarily the same, for the following reason. The refiner can either demand delivery and buy the oil at the spot price or "sell" his contract. In either event, his initial margin is refunded, sometimes with interest. If he buys oil he pays $33 per barrel or $330,000, but his trading profit is $70,000 ($30,000 + $60,000 - $20,000). Effectively, he ends up paying $26 per barrel [($330,000 - $70,000)/ 10,000], which is precisely the January price for December futures. If he "sells" his contract, he keeps the trading profit of $70,000.

Several features of futures are worth emphasizing. First, a party who elects to hold the contract until maturity is guaranteed the price he paid when he initially bought the contract. The buyer of the futures contract can always demand delivery; the seller can always insist on delivering. As a result, at maturity the December futures price for WTI and the spot market price will be the same. If the WTI price were lower, people would sell futures contracts and deliver oil for a guaranteed profit. If the WTI price were higher, people would buy futures and demand delivery, again for a guaranteed profit. Only when the December futures price and the December spot price are the same is the opportunity for a sure profit eliminated.

Second, a party can sell oil futures even though he has no access to oil. Likewise, a party can buy oil even though he has no use for it. Speculators routinely buy and sell futures contracts in anticipation of price changes. Instead of delivering or accepting oil, they close out their positions before the contracts mature. Speculators perform the useful function of taking on the price risk that producers and refiners do not wish to bear.

Third, futures allow a party to make a commitment to buy or sell large amounts of oil (or other commodities) for a very small initial commitment, the initial margin. An investment of $22,000 is enough to commit a party to buy (sell) $260,000 of oil when the futures price is $26 per barrel. Consequently, traders can make large profits or suffer huge losses from small changes in the futures price. This *leverage* has been the source of spectacular failures in the past. (See appendix 5 &6 for futures contract specifications).

7.6 Energy options

An option is a contract that gives the buyer of the contract the right to buy (call option) or sell (put option) at a specified price (strike price) over a specified period of time. American options allow the buyer to exercise his right either to buy or sell at any time until the option expires. European options can be exercised only at maturity.

Whether the option is sold on an exchange or on the OTC market, the buyer pays for it up front. For example, the option to buy a thousand 1000 barrels of crude oil at a price of $50 per barrel in December 2002 may cost $0.73. If the price in December exceeds $50, the buyer can exercise his option and buy the crude oil for $50. More commonly, the option writer pays the buyer the difference between the market price and the strike price. If the Crude Oil is less than $50 per barrel, the buyer lets the option expire and loses $0.73. Options are used successfully to put floors and ceilings on prices.

Energy options comprise a huge global market, competing with energy swaps markets as a means of managing energy price risk. Nymex, the worlds largest energy option exchange, recorded the volume of options traded in 1998 to be 61.7% higher than four years earlier. Nymex started trading energy options in 1986, and it has grown since then. This growth was mainly due to two main factors: the successful launch of an OTC market in swaps from 1986, and the extreme volatility in oil prices in 1990, the year of Iraq's invasion of Kuwait.

In the oil market, OTC options are generally settled in a different way than exchange traded options. Exchange options, if held to maturity, nearly always result in physical delivery of the products. In contrast, OTC options are generally cash settled. Their value at settlement is generally based on the average price over a period of time. Cash settlement options work well in the oil market, as it could be very expensive to exercise the option and then resell the product to capture the increase in value. For example, a refiner may hold an exchange traded call option on crude oil as a protection against a rise in crude prices. Selling this option at an acceptable price is always a possibility, but if the option market is not liquid, then the refinery might need to exercise the option by taking delivery at the underlying future position at the strike price. However, the refiner might prefer to buy his crude oil from another source or for a different delivery date than the crude controlled by the future contract. Then he will need to resell it in order to capture the increase in value beyond the strike price. This might result in an additional commission to pay, or the market might move unfavourably before the future position is disposed of.

One of the main advantages of cash settlement options is that many clients favour settlement based on average prices. Compared to settlements based on a single point in time, they can provide a better hedge for non-specific "cash type" exposure. For example, an oil trader buying and selling cargoes of oil can use large lumps of futures to hedge the large lump of oil. The matching of hedges is easy, because when the trader buys cargo and wants to hedge he can sell an equal quantity of futures to unwind his hedge. For this operation, the futures are sold at a specified moment and bought back at a specified moment within the timing constraint of the ship's voyage.

Options are also increasingly used to hedge cross-market risks. Cash settlement is significantly cheaper in this kind of hedge, because in most cases the buyer is not interested in the underlying commodity of the option, he is merely interested in the price protection that the option provides. For example, a refinery can buy an option on gasoline as a cross market hedge against a rise in the price of crude oil. In this case, the option buyer is not at all interested in acquiring the underlying asset; he just wants to price hedge the value, which is highly correlated with his underlying price exposure.

7.7 Swaps

Swaps (also called contracts for differences) are the most recent innovation in finance. Swaps were created in part to give price certainty at a cost that is lower than the cost of options. A swap contract is an agreement between two parties to exchange a series of cash flows generated by underlying assets. No physical commodity is actually transferred between the buyer and seller. The swaps contracts are agreements between the two counterparties, or principals, outside any centralized trading facility or exchange and are therefore characterized as OTC derivatives.

Because swaps do not involve the actual transfer of any assets or principal amounts, a base must be established in order to determine the amounts that will periodically be swapped. This principal base is known as the "notional amount" of the contract. For example, one person might want to "swap" the variable earnings on a million dollar stock portfolio for the fixed interest earned on a treasury bond of the same market value. The notional amount of this swap is $1 million. Swapping avoids the expense of selling the portfolio and buying the bond. It also permits the investor to retain any capital gains that his portfolio might realize.

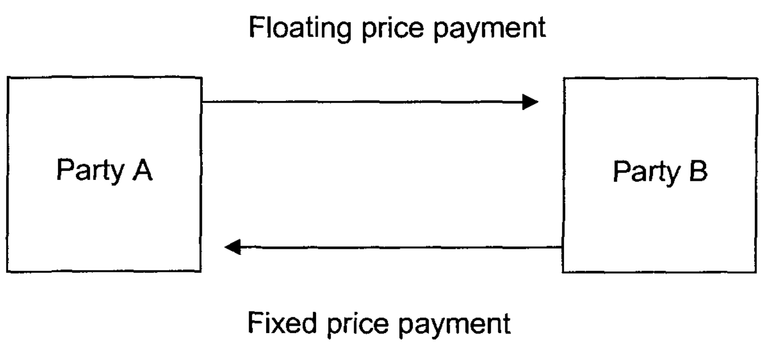
According to Jack Kellet (Standard Bank London Ltd.), the use of swaps as a risk management tool has grown substantially in the last decade. The driving force behind this growth has been the increasing involvement of financial intermediaries. Banks and trading companies that understand market making and risk management have acted as an intermediary, risk takers and structural innovators. They have bridged the gap between market participants who wanted protection from falling prices and those who wanted protection from rising prices. Without these intermediaries, it is unlikely that consumers of oil would be able to match themselves with producers to offset risks of similar size and duration.

Another principle reason why we have experienced this growth is the increase in technical knowledge about the market and the instruments available. As end users develop a deeper understanding of the mechanics of risk control, their inclinations to enter into complex swaps that are tailored into specific needs increase.

As an example of a standard crude oil swaps, assume a refiner and an oil producer agree to enter into a 10-year crude oil swap with a monthly exchange of payments. The refiner (Party A) agrees to pay the producer (Party B) a fixed price of $30 per barrel, and the producer agrees to pay the refiner the settlement price of a futures contract for NYMEX light, sweet crude oil on the final day of trading for the contract. The notional amount of the contract is 10,000 barrels. Under this contract, the payments are netted, so that the party owing the larger payment for the month makes a net payment to the party owing the lesser amount. If the NYMEX settlement price on the final day of trading is $28 per barrel, Party A will make a payment of $2 per barrel times 10,000, or $20,000, to Party B. If the NYMEX price is $33 per barrel, Party B will make a payment of $30,000 to Party A. The 10-year swap effectively creates a package of 120 cash-settled forward contracts, one maturing each month for 10 years.

So long as both parties in the example are able to buy and sell crude oil at the variable NYMEX settlement price, the swap guarantees a fixed price of $30 per barrel, because the producer and the refiner can combine their financial swap with physical sales and purchases in the spot market in quantities that match the nominal contract size. All that remains after the purchases and sales in the inner loop cancel each other out are the fixed payment of money to the producer and the refiner's purchase of crude oil. The producer never actually delivers crude oil to the refiner, nor does the refiner directly buy crude oil from the producer. All their physical purchases and sales are in the spot market, at the NYMEX price.

Figure 4: Cash flow of an oil price swap



Many of the benefits associated with swap contracts are similar to those associated with futures or options contracts. Swaps allow users to manage price exposure risk without having to take possession of the commodity. They differ from exchange-traded futures and options in that they are individually negotiated instruments, users can customize them to suit their risk management activities to a greater degree than is easily accomplished with more standardized futures contracts or exchange-traded options. For instance, in the example above, the floating price reference for crude oil might be switched from the NYMEX contract, which calls for delivery at Cushing, Oklahoma, to an Alaskan North Slope oil price for delivery at Long Beach, California. Such a swap contract might be more useful for a refiner located in the Los Angeles area.

Although swaps can be highly customized, the counterparties are exposed to higher credit risk because the contracts generally are not guaranteed by a clearinghouse as are exchange-traded derivatives. In addition, customized swaps generally are less liquid instruments, usually requiring parties to renegotiate terms before prematurely terminating or offsetting a contract.

8 RELATIONSHIP BETWEEN THE SPOT, FORWARD/FUTURES PRICES AND THE CONVENIENCE YIELD

A distinguishing feature of the oil futures market and the energy market in general is the behaviour of the term structure of futures prices. This term structure shows how oil future prices are dependant upon time to contract expirations. For oil products, the term structure exhibits a variety of shapes.

To provide an analysis of this relationship, let S(t) be the current spot price of one barrel of oil, and F(T) be the forward price at date t to deliver one barrel at date T. For simplicity reasons, let's assume that the delivery only takes place at the expiration date T. Since we focus on the term structure of future prices and its effect on oil derivative value, we can assume that interest rates are deterministic or known. This would ensure that forward prices equal future prices, as described by Jarrow and Oldfield (1981). Therefore, the future price of oil at time t to be delivered at time T would equal F(t,T), the forward price.

Arbitrage implies a mathematical relationship between futures prices with different maturities, and between spot and futures prices. A common example of such a relationship is the traditional "cost and carry" model. This model states future prices must exceed the spot price by the cost of carrying inventory. Let r(u) be the instantaneous forward interest rate at date u, and w(u) be the instantaneous storage cost at date u measured as a portion of the spot price, which is also known at time t (Craig Pirrong, Bauer College of Business at the University of Houston).

Then:

$$F(t,T) = S(t) \exp \left[\int^{T} r(u) + w(u) du \right]$$

In the oil market, this relationship seldom holds. Oil future prices are typically lower than predicted by the simple cost and carry model. This is because of the convenience yield effect.

The convenience yield affects the relationship between the oil spot and futures prices in the same way that a dividend yield affects the relationship between the value of a stock index and a futures contract on that index. Specifically, it drives the futures price below the level implied by the pure cost and carry model because it reduces the opportunity cost of holding inventories.

Formally, we can define y(t,u) as the instantaneous convenience yield, that is perceived by the marginal stores at date t, arising form having a unit of the commodity in inventory at date u. The relation between the spot and futures prices is then given by:

$$F(t,T) = S(t) \exp \left[\int^{T} r(u) + w(u) - y(t,u)]du \right]$$

For simplicity and to avoid excessive notations, we can rewrite this equation as:

$$F(t,T) = S(t) \exp \left[\int^{T} r(u) - Z(t,u)du \right]$$

Where Z(t,u) = y(t,u) – w(u) and this is now the instantaneous forward convenience yield net of physical storage cost.

Intuitively, the above relationship suggests that, in equilibrium, holder of oil must be indifferent as to whether to hold the spot oil or a future contract. Holding the spot oil means that the holder will finance the initial purchase price S(t) at prevailing interest rates, but he also receives the convenience yield of holding the spot oil in inventory. If the above relationship holds, the payoff to the futures contract and a position in the spot c are identical over the interval from t to T. Another implication of the above relation is that the behavior of the convenience yield has an important effect on the dynamics of oil futures and forward prices, hence upon the prices of energy options, swaps.

An economic model called the "theory of storage" has provided an important implication of the convenience yield. This theory predicts that convenience yields should increase with a decline in the supply of the commodity or increase in the demand.

9 BASIS RISK

It is very important for oil companies to consider the risk that is associated with engaging in hedging activities. It is believed that hedgers are able to identify the precise date in the future when an asset would be bought or sold. In addition, it is also believed that hedgers are then able to use future contracts to remove almost all the risk arising from the price of the asset on that date. In actuality, hedging is often not quite as straightforward which can create a basis risk. This can be attributed to the following reasons:

1) The asset whose price is to be hedged may not be the same as the asset underlying the futures contract.
2) The hedgers may be uncertain as to the exact date when the asset will be bought or sold.
3) The hedgers may require the futures contract to be closed out before its delivery month.

Basis in a hedging situation is as follows:

Basis = spot price of asset to be hedged – future price of contract used.

In the cases, where the assets to be hedged and the asset underlying the futures contract are the same, the basis should be zero at expiration of the future contract. Prior to expiration, the basis may be positive or negative. In the oil market, it is more likely that basis would be negative. The reason for that is because future prices of crude Oil tend increase by more than the spot price, so basis declines. This is referred to as a weakening of the basis. Depending on the position of the hedger; basis risk can lead to improvements or worsening of the hedger's position. For a long hedge, if the basis strengthens expectedly, the hedger's position worsens. If the basis weakens unexpectedly, the hedger's position improves. For a short hedge, the reverse holds.

10 DATA AND METHODOLOGY

This study is conducted on 15 US- Oil producing companies. All companies name oil as their primary business segment. Thus, market risk exposures are similar, leading to the conclusion that differences in hedging policies are more likely a result of the differences in firm characteristics.

All the sample companies are headquartered in the USA. The reason for not choosing a diverse sample in terms of geographical locations is the fact that each geographical region has its own distinct environmental, legal, political, and operational conditions that have a strong impact on the companies' policies. For example, some of the international North African oil companies, regardless of their size and firm characteristics, are non-hedgers. This is attributed to the fact that the financial market is not well-established in these regions, and the expertise to engage in offshore derivative instruments is still very limited. This study aims to explain the different derivative engagements by oil companies 8 as well as SFAS 133/13 influence on their strategy.

Firm information on derivative usage, positions and accounting treatments are obtained from their companies' annual reports and their 10K forms. Operational data such as oil reserve statistics and cash cost, as well as financial data such as market value of assets, liquidity ratio and debt ratio for the companies are also collected or calculated with data from the sources mentioned above.

11 DERIVATIVE USE OVERVIEW

Sampled firms are divided into derivative users and non-derivative users groups based on whether they engaged in derivative usage in their fiscal year 2005. 14 out of 15 are derivative users who used derivative instruments to hedge at least one of the three main market risks: namely oil price risk, interest rate risk and foreign exchange risk. However, some of them have a very limited derivative use. Only one firm (Devon co) reported no derivative usage in its annual reports (see appendix 1). These firms didn't mention whether SFAS 133 has any impact on their hedging decisions. Devon Co, has indicated that the current low debt level of their balance sheet makes hedging instruments unattractive to them. Also, this company has stated that their main reason the main for engaging in hedging instruments in the past was to insure that a significant level of cash flow was available to meet debt obligations and to fund their capital budget. However, once most of their debt has been repaid, they became unwilling to use derivatives for hedging. Devon Co also believes that speculating with hedging can never give a reliable prediction. On the other hand, many of the derivative hedging companies indicated that they use derivative hedging to reduce the price volatility, help ensure that they have adequate cash flow to fund their capital programs and manage price risks and returns on some of their acquisitions and drilling programs. Their decision on the quantity to and price at which they choose to hedge their production is based in part on their view of current and future market conditions. In addition, many hedging companies acknowledged in their financial reports the fact that hedging arrangement not only limits the downside risk of adverse price movements, but also future revenues from favourable price movements.

One company from the sample, Conoco Phillips co, stated that they use futures, forwards, swaps and options in various markets to optimize the value of their supply chain, which moves their risk profile away from market average prices in order to accomplish the following objective:

- Balance physical systems. In addition to cash settlement prior to contract expiration, exchange traded futures contract also may be settled by physical delivery of commodity, providing another source of supply to meet our refinery requirement or market demand.

- Meet customer needs, consistent with their policy to generally remain exposed to market prices, they use swap contracts to convert fixed –price sales contract to floating market price.

Oil price risk is the most important risk exposure for oil companies. All of the 14 hedging companies manage oil price risk with derivatives. The foreign exchange risk comes in second place as 50% of the hedging companies use derivatives to manage their exposure to this risk. Finally, interest rate risk is managed with derivatives by 28.5%.

12 RISK MANAGEMENT COMPLIANCE WITH SFAS NO 133/138

SFAS 133, Accounting for derivatives and certain hedging activities, was amended using SFAS No. 138, accounting for certain derivatives and certain hedging activities (2000), the new accounting standards on derivatives and hedging. These standards were forced by the Federal Accounting Standards Board (FASB) for firms to recognize derivatives at fair value on the balance sheet. This amendment was released as a result of the growing use and complexity of the derivative market since the FASB was concerned that the value and risk of derivatives were not well understood by firms. SFAS No. 133/138 requires companies using derivative instruments to document all relationships between hedging instruments and hedged items, as well as risk management objectives and strategies for undertaking various hedged transactions. They must link all hedging derivatives to specific forecasted transactions and then make the assessment, both at the hedge's inception and on an ongoing basis, to determine whether the derivatives used are effective in offsetting the cash flow of the hedged items. In other words, SFAS No. 133, requires fair valuations of all derivatives on the balance sheet; gains and losses on derivatives are recorded immediately in net income.

13 FIRM CHARACTERISTICS AND RISK MANAGEMENT

This study will attempt to evaluate the connection between firm characteristics and risk management strategies in order to determine which type of firm characteristics plays a role in the oil producing companies' risk management decisions. The non-derivative users are also included in the analysis of the firms' characteristics. This may help give us an insight into their non-hedging philosophies. The main firm characteristics included are: firm size, leverage, and liquidity.

13.1 Firm size

Firm size is measured by the market value of assets and the company's total oil reserves. The market value of the assets can be obtained from the market value of equity plus total liability minus the book value of equity. In addition, the company's oil reserve is a common indicator of the firm size. The shareholders maximization hypothesis (Yanbo Jin and Phillippe Joroin) predicts that firm size is negatively correlated with the degree of hedging. Smaller firms, which have limited negotiation power and thus facing higher financing costs, tend to hedge more in order to avoid seeking costly external financing. In the sample, firm market value of assets ranged from US$85.14 million (Harken) to around US$382 billion (Exxon). Ten out 15 firms had a market value over 5 billion US dollars. According to market value of assets and oil reserves, the sample firms can be divided into three size groups:

1) 6 large firms with market value of assets over 5 billion and Oil reserves over 2 billion barrels.

2) 6 medium size firms with either market value assets above 3 billion or oil reserves above 500 million barrels, however, they don't meet both of the requirements of large firms.

3) 3 small firms with market value of assets less than 1 billion and oil reserves less than 500 million barrels.

Conoco Phillips and chevron with a market value near US $127.77 billions and US $140 billions respectively falls under the large firm category. Noble affiliates Inc and forest oil Co. fall under medium size category with market value of 8.8 billions and 3 respectively. Finally, as an example of the small size firm would be Delta petroleum Co. and HarKen energy Co. with market value of 513.983 millions and 85.14 millions respectively. The only Non-hedging firm, Devon, falls under the large firm category with a market value about 35.24 billion.

Based on the sample, there is no direct relationship between firm size and derivative usage. Hedging firms range from small to large companies with various hedging levels.

13.2 Liquidity

Quick ratio is the most commonly used liquidity measure. This ratio is calculated as the ratio of cash, cash equivalents and receivables over short-term liabilities. The quick ratio also gives an indication of the cash balance that a firm has for emergencies. Cash balance is also an important source of funds for investments when present internally generated funds fall short and external funding is costly. It is believed that the larger the cash balance, the less the financial constraint to the firm, which leads to less need to hedge against potential financial hardships. Devon Co, the only non-hedging firm, is among the highest firms in terms of cash balance holdings. HarKen Energy, which has very limited derivative use, has the biggest quick ratio of 3.2.(see appendix 3). Occidental, with limited derivative use, has a relatively high quick ratio. Newfield exploration, with almost 80% of hedged production, has a relative low Quick ratio. Overall, it appears that most of the hedging firms with a high quick ratio tend to have limited derivatives use. This supports the assumption that lower hedging activities are linked to higher normalized (using short-term liabilities) cash balances. In addition, looking at appendix 4, there appear to be a positive connection between the hedging percentage and the cash balances. Firms with low cash balances are tended to hedge higher percentage of their productions, such as, delta Co and Newfield Co, with cash balances of $2,241,000 and $39,000,000 and production hedging percentages of 40% and 80% respectively. Whereas, firms with high cash balances, like Exxon and occidental, tend to use limited hedging activities. See appendix IIII

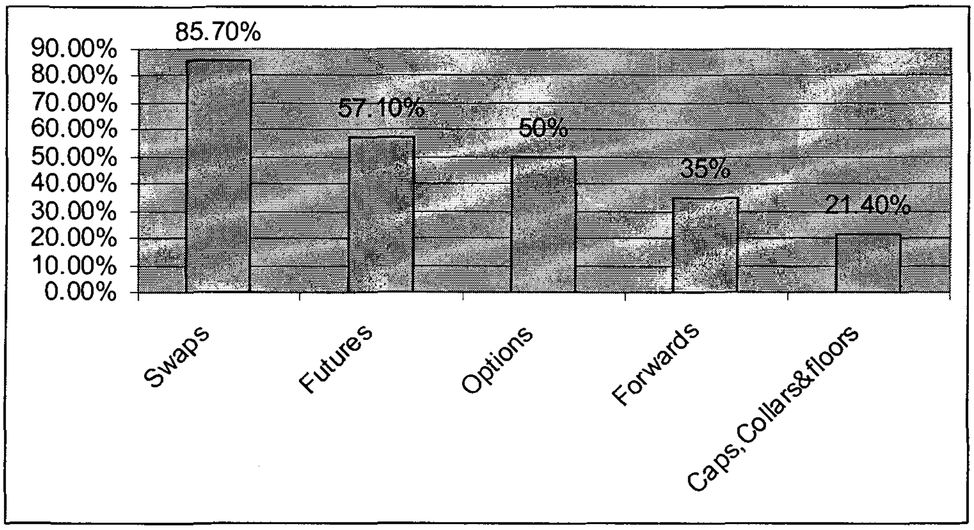
13.2 Leverage

Leverage is defined as the book value of long-term debt scaled by the company's market value of assets (LD/MV). A firm will face financial hardships if it becomes unable to make interest payments on its debts. Whited (1992), and Kaplan and Zinales (1997) argue that firms with higher leverage are more likely to face financial constraints. In the oil industry, a low level of leverage is more common. In the study sample LD/MV ranged from 0.016 to 0.421. And Six firms had LD/MV ratio less than 0.10 However, these firms happen to have very limited derivative use. Moreover, none of them hedge against all the three risks. Most of the hedging firms have LD/MV higher than 0.1. From the sample firms, there seems to be a positive relationship between LD/MV ratio and the level of hedging. This signals another alternative risk management strategy.

14 DERIVATIVE USE FOR OIL PRICE RISK

All the hedging firms manage their oil price risk with derivatives. The primary instruments used by these firms are swaps, forwards, futures and options. Figure (5) shows that 85.7% of hedging firms use swaps for their oil risk exposure. Futures contracts come second in use with 57.1%. Finally, options and forwards with 50% and 35.7% respectively. Other derivatives such as collars are used by 21.4%.

Figure 5: Derivatives used for Oil price Risk



The hedging horizon of the firms varies between 1 to 6 years in which most of them hedge only one to two years ahead. Apparently, oil-producing companies concentrate their derivatives usage on the short term. The reason behind it is that oil producers believe anticipating long term prices is irrelevant and almost impossible, therefore, they shorten the hedging period to take advantage of the market spot price.

15 DERIVATIVE USE FOR FOREIGN CURRENCY RISK

50% of the derivative users (7 firms) hedge foreign currency risk. The most frequently used contracts are forward contracts (used by 3 firms), followed by swaps, futures, and options contracts with 1 firm each. The average hedging horizon is 2 years.

The majority of oil producing companies has international operations in different parts of the world. However, because oil prices are quoted and traded in world markets using US dollars, many US oil firms do not engage in foreign currency derivatives. The US dollar is considered the primary currency for each of the companies' international operations. The limited transaction that is completed on foreign currency is translated into US dollars and recorded on the financial statements. In addition, most firms declared that instead of engaging in currency derivatives, they balance their exposure to currency risk by balancing monetary assets and liabilities and maintain domestic cash positions only at levels necessary for operation purposes.

16 DERIVATIVE USE FOR INTEREST RATE RISK

Interest rate exposure is managed by 28.5% of the derivative users (4 firms) and all of them use only swaps, except for one firm (Noble Energy), which uses both swaps and forwards. This low leverage in the oil industry explains why interest risk is perceived as less vital than oil price and currency risk. One of 3 firms has maturity between 1 to 4 years whereas the other two firms have 2-year maturities.

Leverage can be regarded as an important measurable determinant of the interest rate exposure because a large part of this kind of exposure originates from the liability carried by the company. On the other side, firm liquidity can work as a shield or barrier that blocks unfavourable interest rate movements so as to decrease the expected cost of the financial distress. Consequently, interest rate exposure is expected to be negatively associated with the firm liquidity level. Data from the sample moderately supports the hypothesis that interest rate exposure is positively related to leverage as three of the four firms have a comparatively high LD/MV ratio. On the other hand, the same three firms have a reasonably low Liquidity ratio. This supports the theory that there exist a negative relationship between firm liquidity and interest rate exposure, since these three interest rate hedging firms have a liquidity level lower than the sample average (0.96).

17 CONCLUSION

This paper examines the post SFAS No. 133/138 derivative use by 15 US oil-producing companies. It assesses the relationship between certain firm characteristics and risk management practices. According to this paper's findings, oil price risk is the most important risk exposure for the sample used, followed by foreign currency risk then interest risk. Based on these findings, it is unclear whether or not firm size plays a main role in the decision to engage in derivatives. Firms of different sizes do not use or limit their derivative usage, whereas others of similar sizes are engaged in derivative usage. Liquidity ratio and long term debt appear as factors in a firm's decision to hedge. Also, It has been found that liquidity ratio has a negative relationship with hedging; the higher this ratio the lower the tendency to hedge with derivatives. On the other hand, the long-term debt level is found to have a positive relationship with derivative usage; the higher this level, the higher the tendency to hedge. Eleven firms (78.5% of derivative users) have provided a clear definition of the SFAS No 133/138 and have complied well with its requirements. However, there appear to be different levels of financial disclosure as well as a positive relationship between the volume of derivative usage and the level of disclosure. Swaps are the dominant derivative used to hedge oil price risk, whereas futures contracts were used more to hedge foreign exchange risk. Short hedging horizons are chosen by most firms for all three risks with relatively longer horizons, on average, for interest rate risk. Finally, this paper found that SFAS No 133/138 does not affect financial disclosure, hedging product choice or accounting treatment for derivatives.

APPENDIX 1: SAMPLE FIRMS

Sample firms with derivative use

ANADARKO PETROLEUM CORP

APACHE CORP

CABOT OIL CORP

CHEVRON CORP

CONOCOPHILLIPS CORP

DELTA PETROLUIM CORP

EXXON CORP

FOREST OIL CORP

HARKEN ENERGY CORP

MURPHY CORP

NEWFIELD EXPLORATION CO

NOBLE ENERGY

OCCIDENTAL PETROLUIM

POGO PRODUCTION CO

Sample firms with no derivative use

DEVON ENERGY CORP

APPENDIX 2: DERIVATIVE INSTRUMENTAL USE

Company name	Price Risk	Foreign Risk	Interest Risk
ANADARKO PETRO CORP	Futures, swaps & Options	Forwards	No hedge
APACHE CORP	Futures,Forwards, options &swaps	Swaps	No hedge
CABOT OIL CORP	Swaps, Options	Options	No hedge
CHEVRON CORP	Swaps, Options &futures	Forwards	Swaps
CONOCOPHILLIPS	Swaps, Futures & forwards	Forwards	No hedge
DELTA PETRO	Futures, Swaps & Options	No hedge	No hedge
EXXON CORP	Swaps, Forwards	No hedge	No hedge
FOREST OIL CORP	Swaps, Futures	Futures	Swaps
HARKEN ENERGY	Price floor contracts	No hedge	No hedge
MURPHY CORP	Swaps, Forwards & options	No hedge	No hedge
NEWFIELD EXPL	Swaps & collars	No hedge	Swaps
NOBLE ENERGY	Swaps, futures	No hedge	Swaps, forwards
OCCIDENTAL	Swaps, futures forwards & options	No hedge	No hedge
POGO PROD CO	Futures & collars	swaps	No hedge

APPENDIX 3: RATIOS & SFAS 138/133

Company name	Quick Ratio	LD/MV Ratio	SFAS138/133
ANADARKO	1.106	0.241	Not defined
APACHE CO	0.56	0.088	Defined
CABOT OIL CO	0.818	0.117	Defined
CHEVRON CO	1.089	0.084	Defined
CONOCOPHILLIPS	0.626	0.083	Defined
DELTA CO	0.235	0.421	Defined
DEVON ENERGY	1.094	0.148	Not defined
EXXON CO	1.212	0.016	Defined
FOREST CO	0.209	0.294	Not Defined
HARKEN CO	3.2	0.146	Not defined
MURPHY CO	1.127	0.061	Defined
NEWFIELD CO	0.61	0.143	Defined
NOBLE ENERGY	0.537	0.228	Defined
OCCIDENTAL	1.328	0.070	Defined
POGO PROD CO	0.649	0.355	Defined

APPENDIX 4: CASH BALANCES AND HEDGE PERCENTAGES

Company name	Cash balance and equivalents	Hedge percentages
ANADARKO	$739,000,000	25%
APACHE CO	$228,860,000	6%
CABOT OIL CO	$2,730,000,000	33%
CHEVRON CO	$10,043,000,000	20%
CONOCOPHILLIPS	$2,214,000,000	15%
DELTA CO	$2,241,000	40%
DEVON ENERGY	$1,606,000,000	None
EXXON CO	$22,400,000,000	10%
FOREST CO	$7,231,000	40%
HARKEN CO	$46,200,000	NA
MURPHY CO	$585,333,000	22%
NEWFIELD CO	$39,000,000	81%
NOBLE ENERGY	$110,321,000	25%
OCCIDENTAL	$2,189,000,000	4%
POGO PROD CO	$57,749,000	10%

APPENDIX 5: SPECIFICATIONS – STANDARD FUTURES CONTRACT

ICE WTI Crude Futures[1]

Introduction

The ICE WTI Crude Futures contract was introduced on February 3, 2006.

ICE offers a fully-electronic platform and is the world's leading electronic energy marketplace. The ICE WTI Crude Futures contract joins the global benchmark Brent Crude futures contract to provide traders, hedgers and speculators with the world's leading crude oil contracts on a single electronic platform.

Contract Specifications

Trading Hours (Sun - Fri)	London (GMT) / New York (EST) / Chicago (CST) Open*: 01:00 / 8:00pm / 7:00pm Close: 22:00 / 5:00pm / 4:00pm Settle: 19:30 / 2:30pm / 1:30pm *Except Monday morning/Sunday evening when the opening time is 00:00 London (local time), 19:00 New York (EST), 18:00 Chicago (CST).
Unit of Trading	One or more contracts of 1,000 barrels
Quotation	U.S. dollars and cents per barrel
Minimum Price Fluctuation	One U.S. cent ($0.01) per barrel, equivalent to a tick value of $10
Maximum daily price fluctuation	None
Margins	Marked-to-market by LCH.Clearnet on a daily basis, or as market conditions might require. Up-to-date Margin Rates may be found by clicking on "ICE Futures Margin Circular" at http://www.lch.com/risk_and_margining.
Contract Expirations	Consecutive months out to Dec 2011, plus June 2012 and December 2012.
Position limits	None
Fees	Screen transactions: $0.70 per contract per side. Screen fees are waived until March 31, 2006. EFP's, EFS's and Blocks: $1.20 per contract per side. LCH.Clearnet fee is $0.12 per contract per side.
Last Trading Day	Trading shall cease at the close of business four U.S. business day prior to the 25th calendar day of the month preceding the contract month.
Settlement	The ICE WTI Crude Futures contract is cash settled on a monthly basis against the prevailing market price for U.S. light sweet crude. The price is equal to the settlement price of the Light Sweet Crude Oil futures contract, in USD per barrel, as published by NYMEX for the month of production on the last trading day for the ICE WTI Crude Futures contract - as further detailed within the ICE Futures Regulations, including the relevant reference to the 2005 ISDA Commodity Definitions.
Quote Vendor Codes	Quote vendor symbols are available on the ICE website. For more information, visit: http://icedata.theice.com/ice/docs/QV_System_Codes_2006.pdf

[1] Available to the public at:// www.theice.com/futures.jhtml

APPENDIX 6: CONTRACT SPECIFICATION

ICE Futures Brent Crude[2]

Contract Specification

Date of launch
23 June 1988.

Trading Hours

	London (local time)	New York (EST)	Chicago (CST)
Open*	01:00	20:00	19:00
Close	22:00	17:00	16:00

* Except Monday morning/Sunday evening when the opening time is 00:00 London (local time), 19:00 New York (EST), 18:00 Chicago (CST).

Unit of trading
One or more lots of 1,000 net barrels (42,000 US gallons) of Brent crude oil.

Specification
Current pipeline export quality Brent blend as supplied at Sullom Voe.

Quotation
The contract price is in US dollars and cents per barrel.

Minimum price fluctuation
One cent per barrel, equivalent to a tick value of $10.

Maximum daily price fluctuation
There are no limits.

Daily margin
All open contracts are marked-to-market daily.

Trading period
Consecutive months out to Dec 2011, plus June 2012 and December 2012.

Position limits
There are no limits to the size of position.

Delivery Mechanism

Cessation of trading
Trading shall cease at the close of business on the business day immediately preceding the 15th day prior to the first day of the delivery month, if such 15th day is a banking day in London. If the 15th day is a non-banking day in London (including Saturday), trading shall cease on the business day immediately preceding the first business day prior to the 15th day. These dates are published by the Exchange.

[2] Available to the public at: // www.theice.com/futures.jhtml

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Chevron Corp.www.chevron.com

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Delta Petroleum Corp. www.deltapetro.com

Exxon Corp.www.exxon.com

Forest Oil Corp.www.forestoil.com

Harken Energy Corp. www.harkenenergy.com

Murphy Corp. www.murphyoilcorp.com

Newfield Exploration Co.www.newfld.com

Noble Energy www.nobleenergyinc.com

Occidental Petroleum. www.oxy.com

Pogo Production Co. www.pogoproducing.com

Devon Energy Corp. www.devonenergy.com