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Oil and Gas Futures and Options Market

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Review scientific paper

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Abstract

Energy mineral resource markets are represented by complex supply and demand ratios which are depending on different factors such as technical (transport) and geopolitical. The main characteristicof energy markets is represented by an uneven geographic distribution of hydrocarbon reserves and production on one hand, and energy consumption on the other. World oil markets, although geographically localized, because of specific market trade, represent a unique global market with a decreasing price difference. Price differences are the result of the development of transport possibilities of oil supply. The development of transport routes of natural gas and an increasing number of liquefied natural gas terminals in the world give pressure to the natural gas market and its integration into the global gas market. The integration of regional gas markets into a common European gas market is the main energy policy of EU concerning natural gas. On the other hand, there are still significant price differences on some markets (e.g. United States of America - South East Asia). The development of global energy markets is enabled by the development of futures and options contracts of an energy trade which have replaced bilateral contract deals between producers and consumers. Futures contracts are standardized contracts traded on exchanges. A buyer agrees to buy a certain quantity of stock for an agreed upon price and with some future delivery date. An option is a contract which gives a buyer the option of the right to buy (or sell, depending on the option) an asset at a predetermined price and at a later date. A stock's price risk can be managed with the purchase and selling futures and options contracts. This paper deals with futures and options energy markets and their market strategies.

Keywords

Futures contract, options, market risks, oil market, gas market

1. Introduction

Crude oil and natural gas are hydrocarbon energy resources, or fossil fuels that enabled the development of today's world economy. Trade of these resources represents the majority of trade on energy markets. Aside from supply and demand, the market is determined by the opportunity of transport and also transport costs. The crude oil market is fully internationalized since oil can be transported by pipelines, marine oil tankers and road and railway cisterns. The natural gas market is also dependent on transport network construction because natural gas is only available where a network exists. With the development of liquefaction technology (Liquefied Natural Gas - LNG) and the construction of LNG terminals, the natural gas market expanded. Besides common factors influencing the market, market speculation is also one of the main characteristics of the oil and natural gas market.

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The oil market is represented with supply or exploitation of oil on one side and refinery processing or petroleum products consumption on the other. The unique feature of the oil market is the fact that major oil producers are not the biggest consumers and oil reserves are not evenly geographically distributed. This led to the development of a single global oil market with several geographic locations in the world as main markers for the determination of crude oil price. The main crude oil markets in the world are the North Sea, West Africa, the Mediterranean market, the Persian Gulf, the Asian region and the East and West coast of the United States. Depending on the market, there are several markers for crude oil price, such as Dated Brent, Dubai/Fateh, West Texas Intermediate (WTI), Alaska North Slope, (ANS) and Tapis & Minas. Crude oil price depends on a series of factors, some of which are market influence, crude oil and petroleum products' quality, location of reserves, security and availability of supply. Due to high fluctuations in crude oil prices and prices of other energy sources, coupled with development in information technolo-

gy, developments in financial theory and a political climate favoring market solutions (as opposed to government solutions), development of financial derivative markets took place. Financial derivatives represent financial assets whose value comes from an underlying asset. Risk is therefore transferred from a party who wants to take less risk to a party who is ready to take the same risk for a certain price. If a financial derivative is based on some form of energy, it is referred to as an energy financial derivative, and it can be a futures or options contract. These contracts are being exchanged on futures and options markets.

2. Oil and gas futures markets

Crude oil is the commodity which is most dynamically traded worldwide and oil prices have very high volatility, which has been obvious in the past fifteen years (**Robe et al., 2016**).

Futures markets are intermediaries between anonymous sellers and buyers. In reality, only 5% of deliveries (oil or other merchandise) from this kind of contracts are realized. The rest of the contracts are being used for managing price risks in order to net out the contracts. In other words, a buyer of crude oil futures (long position) will sell crude futures. Since the percentage of realized deliveries is very low compared to deliveries that are actually made, these futures contracts are sometimes referred to as paper barrels. Hydrocarbon futures markets are places where futures contracts are sold, and these contracts represent the obligation of buying or selling hydrocarbons (crude oil, natural gas) on a specific date in the future. By buying a futures crude oil contract on some exchange, for example the New York Mercantile Exchange – NYMEX, one buys 1000 barrels (1 barrel – 159 liter) at a certain price with delivery on a date that is stated in the contract. It is also necessary to pay a fee and a margin, which is less than 5% of the value of the contract. One of the main characteristics of futures contracts is that their prices are determined every day on the market. If a participant wants to leave the market and stop with the transactions, he can close his position by taking the opposite position at a certain futures price and realize gain or loss (which are ascribed to a margin account) compared to the original contract. A buyer assumes a long position, while a seller assumes a short position. The participants earn money when the price of delivery increases (buyer) and when the price decreases (seller), which is credited to and debited from a margin account. If a margin account drops below the daily minimum, it has to be brought up to the required level or the position of the participant is liquidated. This type of exchange decreases the risk of unfulfilled derivative contracts and it makes holding the contract on small margins possible (**Dahl, 2004**).

It is important for the margin to be adequately set, since a margin that is too high can reduce market depth and liquidity due to added costs which come along with higher margins. Margins must limit speculative positions taken by undercapitalized traders or there might be significant losses, which result in reduced profit and increased costs of trading. Based on historic and projected future market conditions, volatility and price levels, the Margin Steering Committee on the NYMEX decides on margin requirements. The Committee is governed by the Statistical Portfolio Analysis of Risk (SPAN) system, which estimates by simulation the impact of changes in futures prices during the day. Based on these estimates, margins for protecting the solvency of the futures exchange can be set, but the SPAN system sometimes overstates the margin. High dependency of initial margins on the volatility of the futures market complicated margin determination (**Day et al., 2004**).

Figure 1 shows trends of crude oil prices (weekly Cushing WTI spot prices) in the period from 1986 to 2017 and it is clear that the price varied significantly. Such occurrences happened in the beginnings of the petroleum industry and that is the reason why first futures contracts were made in Pennsylvania in 1860. The first contracts took the form of pipeline certificates.

In the next 30 years, futures exchange started to develop in the United States, Canada and Europe, where trade of crude oil futures took place. Oil price stabilization followed Rockefeller's monopoly (Standard Oil) and vertical integration and multinational control of the market, and the price continued to be stable until the 1970s, when oil shocks occurred. Oil shocks and deregulation of the gas and electricity market caused fluctuation in crude oil prices, which led to a need for price risk management. This was the main reason why futures contracts were developed for electricity, natural gas, etc.

Since financial derivatives (forward and future contracts, swaps and options) lean on an underlying commodity, it is natural that they reflect the commodity's spot price. This connection between prices can be seen in the long run. In the short run, spot and derivative prices differ, which can be explained by seasonal patterns of consumption, insufficient inventory levels, lags in information transmission and thin trading. Backwardation means that futures prices are below the oil spot prices and this price difference occurs in the short run. Spot and future prices do not coincide during the life of the futures contract, but must converge once the contract expires. It is not quite clear whether the same fundamentals drive spot and futures prices (oil reserves, interest rates and macroeconomics variables), because futures prices reflect the expectation of a commodity's spot price. Some other factors influencing spot and futures prices are demand and supply conditions and the exchange rate of the US dollar (**Maslyuk et al., 2009**).

Research (**Polanco-Martinez et al., 2016**) showed that the spot price of WTI was very volatile in 2014 and 2015 (quoted prices declined rapidly), while long-term prices in future market were not that volatile. Long-term

Figure 1: Weekly Cushing WTI spot prices (**URL 3**)

WTI futures prices also declined, but „to a lesser extent." (**Polanco-Martinez et al., 2016**)

Futures prices can be represented by a curve (maturity in years vs. dollars per barrel) and the shape of this curve shows the spread between futures and spot prices. The spread reflects the storage price. At the end of 2015 and the beginning of 2016, spot prices of WTI were „lower than long term maturity futures prices (contango)." (**Polanco-Martinez et al., 2016**).

2.1. Hedging on futures markets

Futures contracts can be used for hedging (risk reduction), speculation, taking the risk for some expected profit and for planning cash flow for storage, transport and oil processing. Hedging is an important part of the market due to variations in production and seasonal effects and due to high oil price volatilities (**Maslyuk et al., 2009**). A hedger is a buyer or a seller (refinery or oil producer) of real merchandise (oil) who takes a position opposite to one in a futures market. A producer who owns crude oil can say that his position is long in oil, therefore he sells or shortens his position in the futures market. A refinery short in oil buys futures, and a speculator (who is neither a buyer nor a seller) takes on the risk for a profit (**Dahl, 2004**). Traders who need large quantities of crude oil protect themselves from a price increase by taking positions in crude oil futures markets. They implement a long hedge in the market in order to secure oil prices for delivery that will take place sometime in the future. In order to ensure this long hedge position, a certain number of futures contracts must be purchased to cover the quantity of oil necessary for trading. Every saving in the spot market is offset by futures oil price in the futures market (**URL 2**). Crude oil producers can protect themselves from decreasing oil prices by taking up positions in crude oil futures markets. They can employ a short hedge to ensure that their future delivery (delivery can only be made in the future) is sold at the exact price. In order to implement their short hedge, producers sell crude oil futures in futures markets and in that way they cover the quantity of oil that is to be produced in the future (**URL 2**). If a trader wishes to hedge, he sells a forward contract (bilateral, unstandardized agreement to buy or sell a product with deliveries in the future. These contracts can't be sold on an organized exchange nor can be resold without the agreement of both sides) in some time t for a delivery in time T at a price . Suppose that the contracted forward price is = $18 for oil delivery at time T. It means that a trader made a deal to sell oil for 18 USD per barrel at time T. At time T, the contract is worth () per barrel. If a trader contracted selling oil at a price of 18 USD/bbl, and others sell oil for $17/bbl, the contract is worth $1. If the price goes up to $19, the trader loses $1. Table 1 shows losses and gains in the spot and forward markets (**Dahl, 2004**).

Table 1 Gains and losses in spot and forward markets at different prices (**Dahl, 2004**)

S_T **(USD)**	$S_T - S_t$ **spot market (USD)**	$F_t^T - S_T$ **forward market (USD)**	**Combined market (USD)**
17	-1	1	0
18	0	0	0
19	1	-1	0

It is evident that what a trader gains or loses in the real market is offset in the futures market. This way, the real volatility of prices is reduced, while the cost represents the cost of transport. The buyer of the futures contract can be some other hedger, such as a refinery, or the buyer can be a speculator. Speculators are exposed to the full risk of price changes in the market, and they take on risks, while hedgers reduce risks. Every trader present in

the derivative and product markets is considered to be a hedger, while speculators don't deal with physical products (**Dahl, 2004**).

Day et al. (**2004**) found that hedging is independent of volatility, which means that hedging demand is inelastic during normal futures market volatility periods. On the other hand, speculative trading is "positively related to changes in volatility" (**Day et al., 2004**).

2.2. Arbitrage

An important parameter that influences futures prices is arbitrage. It can be described as the simultaneous buying and selling of the same product with a goal of making a profit without cash or risk. For example, if crude oil is traded for a price of $43.04/bbl in one market and $43.05/bbl in some other market, crude oil can be bought for $43.04/bbl and sold for $43.05/bbl and thus making a profit. The profit will be realized if the transaction cost doesn't exceed $0.01. Arbitrage ensures the same price across the whole transparent and competitive market, except for transport and transaction costs.

Assume that a buyer buys a treasury bill for 19 000 USD. The same bond can be redeemed at its maturity in 12 months for 20 000 USD. This way a buyer receives an income from the price difference of $1000 after 12 months. This income will only be received if the buyer sells the bill on the day of its maturity, after 12 months. If the buyer needs cash and plans on selling the bill earlier, he holds the price risk, since the bill price varies as the interest rate changes until the maturity. One way of avoiding the price risk is by buying a futures contract, but only if the price in the futures contract is properly set. The futures price in these contracts is formed upon several factors. Suppose the owner sells a bill at some time T, where T represents some date before the maturity of the bill. The owner takes the futures contract for time T. The price for this futures contract can be expressed (**Equation 1**):

$$F_t^T = S_t e^{r(T-t)}, \tag{1}$$

where:

FTt – futures price at time t to be paid in time T,
St – current spot price,
r – risk free rate of return (in this example cost of carry),
T – time of selling the bill (date before the maturity of the bill),
t – time of maturity of the bill.

Unlike futures prices of the stocks or the bonds, that are only under the influence of interest costs, forming of the prices of energy products is affected by interest and transport costs (**Dahl, 2004**). If someone owns a barrel of oil "today" for a current price (S_t), the cost of delivery (which at the same time represents the price of the futures contract at time t for the delivery in time T) would be (**Equation 2**):

$$(S_t + U_t)e^{r(T-t)}, \tag{2}$$

where:

St – current (spot) price,
Ut – unit storage cost at time t.

Assuming that the storage cost is some constant percentage of the spot price (eμ), the futures price at time t is (**Equation 3**):

$$F_t^T = (S_t)e^{(r+\mu)(T-t)}, \tag{3}$$

where:

μ – storage cost.

When trading the commodities that are actually consumed, it is possible to achieve additional benefits from holding reserves, and this benefit is called a convenience yield (). Its main purpose is to stabilize the production process. In case of shortages, prices will increase and the benefit of higher prices will be achieved. Also, it is possible to create losses in times of low prices (low demand or excess in supply), and the owners are burdened with costs of holding inventory. If owners achieve additional net benefits, this benefit (convenience yield ()) can be subtracted from the costs of holding the reserves, and the formula then becomes (**Equation 4**):

$$F_t^T = (S_t)e^{(r+\mu-\delta)(T-t)}, \tag{4}$$

If $r + \mu - \delta > 0$, then $r + \mu > \delta$, which means that the convenience yield is smaller than the carrying cost, where carrying costs include interest and storage costs. This kind of market is referred to as a contango market and the futures contract price in this market increases.

Maslyuk et al. (**2009**) found oil spot and futures prices to cointegrate, and when two markets cointegrate, arbitrage brings markets together in the long run. That is why information from Brent futures market can, to a limited extent, only be used for making riskless excess profits on the WTI spot market (**Maslyuk et al., 2009**).

2.3. Efficient market

One of the advantages of futures markets is price transparency and information on the expected energy prices, and such a market is considered to be an efficient market. A good predictor of the spot price can be the futures price with any necessary risk premium added. The expected spot price in an efficient market can be described with **Equation 5**:

$$E\left(S_T\right) = F_t^T + RP_t, \tag{5}$$

where:

$E\ (S_T)$ – expected spot price,
F_t^T – futures price,
RP_t – risk premium.

The absence of the risk premium suggests that the hedgers dominating on the market on both sides are roughly equal in number, and there is no need for speculators. If there are a certain number of speculators in the

market, the risk premium is not equal to zero. A statistical test of the market efficiency under the assumption of zero risk premium, can be described with **Equation 6**:

$$S_T = \alpha + \beta F_t^T, \quad (6)$$

Risk premium is equal to zero and the market is efficient when and are 0 and 1 respectively. If that's not the case, the market is inefficient and/or has a risk premium (**Dahl 2004**). The efficiency of a futures market is actually the "combined efficiency of the commodity spot and futures markets." (**Maslyuk et al., 2009**).

2.4. Crack and spark spreads

The trading strategy known as crack spread involves a combination of various derivatives in trading. For example, a refinery that buys crude oil and sells oil derivatives makes a profit from the price difference. The refinery in this case is more interested in the price difference of crude oil and its product rather than in the absolute price level of each. A crack spread can be calculated as the weighted value of the refinery's product minus the price of crude oil. The weighted value is a result of the multiplication of each refined product with its share in total refinery production. A crack spread is negative if the crude oil price is greater than the price of the refinery products. To stabilize the spread between crude oil price and the price of the refinery product, a hedger can buy futures contracts for oil and sell futures contracts for oil derivatives. The main parameter that defines crack spread is the ratio of quantity of crude oil (oil that enters the refinery process) and the quantity of refinery products obtained by oil processing. Different oil types yield different refinery products with different values. In America, three barrels of crude oil yield two barrels of gasoline and one barrel of fuel oil (3:2:1). In Europe, this ratio is 6:3:2:1, which means that six barrels of crude oil yield three barrels of gasoline, two barrels of distillate and one barrel of oil residue (**URL 1**).

A spark spread stimulates profit from a power plant, and it is a way of assessing the profit that can be achieved by using natural gas (and in some rare cases oil) as an energy source in thermal power plants. A spark spread is a difference in price of produced electricity that is sold in the market and the price of natural gas needed for the production of that electricity. Its calculation is based on daily spot prices of natural gas and the price of electricity at various regional trading points.

The main component of the value of the spark spread is heat rate, which is a measure of the efficiency of a generating unit. **Figure 2** shows the relationship between the efficiency of a generating unit and heat rate. The heat rate of 7000 Btu/kWh is typical for relatively new and efficient plants where electricity is produced in a combined cycle. A higher heat rate indicates lower efficiency, because generating units require more natural

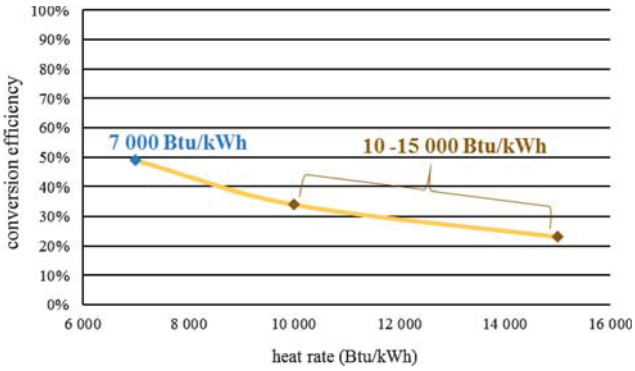

Figure 2 The relationship between conversion efficiency and heat rate (**URL 4**)

gas for producing 1 kWh of electricity. A spark spread depends on the conversion efficiency because as a generating unit's efficiency decreases, the spark spread also decreases (**URL 4**).

3. Options markets of hydrocarbons

If participants in the market want to protect themselves or want to make a profit from rising or falling prices, they can turn to options markets. For example, in options markets, the electricity producer who uses gas as fuel can set the upper limit to the price of the fuel and the lower limit to the price he gets for electricity. Options are types of derivative financial instruments that allow (but do not obligate) the contract holder to buy or sell an asset at a certain set price (strike or exercise price) by a certain date. They can be described as contracts between two parties that give a buyer a right (but not the obligation) of buying (call option) from a seller (writer) or selling (put option) the futures contract (specified by option) at a predetermined price and at any time before the maturity of the option. Energy futures options have futures contracts as underlying assets instead of physical merchandise. Considering the possibility of options exercise, there are American and European options. The American put or call option can be used at any time up to the expiration date, while the European put or call option can only be used on the expiration date. Trading with options on futures contracts started in 1982 on futures exchanges, where options on almost all futures contracts (which are traded on that basis) were offered. Options can be traded in three ways (as futures contracts), on exchanges by loud shouting, using the telephone, or electronically. Options can refer to commodity futures contracts and various securities (government and other bonds), foreign currencies, etc. Options offer investors a series of possibilities such as speculation, hedging and managing the market risks or arbitrage. The advantages of options are a potentially great profit, shed of risk, financial leverage, flexibility and the possibility of staying in market without owning market assets (**Gardijan, 2010**).

3.1. Options trading

According to **Lazibat** (**2001**), a strike or exercise price is a price at which a buyer of a call option has the right to buy a futures contract and a buyer of the put option has the right to sell a futures contract. Behind every buyer of a call option stands a seller of a call option, just as behind every buyer of a put option stands a seller of a put option, and in both cases the buyer of the option pays the seller a certain amount of premium as a fee for cession of the right to buy or sell a futures contract in a certain time period and at a specific strike price. A premium is a sum of the intrinsic and time value. The real (intrinsic) value is equal to the amount for which some option is in-the-money, and the time value is the amount of money that buyers are willing to pay for an option, or the amount of money that a seller of the option is willing to accept for writing an option. If a call option is in-the-money, its strike price is below the current trading price. A put option is in-the-money if its strike price is above the futures price. Otherwise, options are out-of-the-money. If a strike price is equal to the futures price, options are at-the-money. It is assumed that with time, out-of-the-money options will become in-the-money options, and an option that is in-the-money will go deeper in-the-money. Time value is determined with three factors, short-term risk free interest rate, the length of time remaining to exercise the option and the volatility of the price of a futures contract.

Every buyer of the option (call or put option) can let the option expire, take the opposite position or exercise the option. If the price of a commodity in the futures market goes in the opposite direction than anticipated (for the buyer of a call or put option), then the trader will simply let the option expire. This way he will lose the amount of the paid premium, but this will prevent a higher loss, which would be achieved if the option were to be exercised by taking up a long or short position in the futures market at the time when prices follow the opposite trend.

Taking the opposite position (counter buying or counter selling) in an options market is a situation in which a buyer of the option can sell his option. If he buys the same option, he falls out of the market automatically, since his position is cancelled out. It is understandable that a premium that is received for a sold option can be higher or lower than the premium that was paid for the purchased option. The difference between premiums will depend on changes in a commodity futures price in the meantime. Buying an option (call or put) is characterized with limited risk and unlimited potential profit, while selling an option is characterized by unlimited risk and limited potential profit. The main motive for selling an option is the premium, the money that the seller of the option receives from the buyer and it can be considered as profit from an investment, or as a means of increasing the profit and lowering the risk.

3.2. Trading with crude oil options

Crude oil options are option contracts with crude oil futures contracts as underlying assets. The owner of an option has the right (but not the obligation) to take up a long (in the case of a call option) or a short position (in the case of a put option), taking the price of a futures contract into account. This right expires on the date of maturity of the option. Option contracts are traded at the New York Mercantile Exchange for crude oil markers Brent and Light Sweet. Options prices are expressed in dollars and cents per barrel, and a futures contract is created for 1000 barrels. Buyers who expect an increase in oil prices buy call options, whereas traders who expect oil prices to fall buy put options (**URL 2**).

3.3. Strategies of options trade

Speculators (dealers) of futures contracts and options are fairly familiar with strategies of such trade, and having in mind different psychological profiles and market expectations, gamblers, bankers and traders can be distinguished. A gambler is convinced that sudden and dramatic changes in market prices will occur, he isn't interested in small profit and for him it's "all or nothing". A banker is unwilling to take on risk and is satisfied with a minimum profit. A trader can be described as someone who knows a great deal about markets and prices, is realistic in estimation, balances risk and profit and is the most successful participant of a futures market. There are simple and complex options trading strategies. Simple strategies include only options trading, while complex strategies include a combination of buying and selling options and futures contracts. Simple option strategies consist of just one action, only one investment activity which results in one position. The types of simple option strategies are buying a call option, buying a put option, selling an uncovered (naked) call option and selling an uncovered (naked) put option.

Buying a call option means that an investor is extremely optimistic (bullish) and expects a rise of the option price so he negotiates with a seller of the option for a price lower than that in the future (seller is extremely pessimistic – bearish – and expects a decrease in the futures prices). The risk that the investor takes is the amount of premium paid in advance, so in case that a prediction is wrong and prices fall, the investor loses the whole or just a part of the premium. An investor's profit is the difference between the market price and the lower contracted price (exercise), and it is realized when market prices start to rise. By buying a put option, the trader (speculator) expects the price of the underlying stock to decrease, in other words he employs a bearish strategy. The risk that a speculator takes is limited to the amount of premium that has to be paid in advance, whereas the profit is unlimited as long as the futures price of the option asset falls (**Lazibat, 2001**).

The goal of writing an uncovered call option is making a cash inflow in periods of stable market. The strategy of writing uncovered options carries a big risk since the value of the option increases proportionally with an increase in the futures price of an underlying asset from the moment the call option goes significantly in-the-money. The seller of the naked call option is neutral or moderately bearish, where the trader expects the price of a certain futures contract to stay unchanged or decrease a bit and in that case, he receives a profit.

Writing a naked put option represents a situation in which an investor sells a put option related to assets that he doesn't have. In case that the option is exercised, a seller must buy an asset from the owner of the option. An investor expects an increase in the prices and he sells the put option for a certain price. His expectations are bullish and he hopes the prices will rise so that the owner of the option won't sell at the strike price, which is below the market price. Unlike a short uncovered call strategy, where potential loss is unlimited and profit is limited, short put strategy is characterized by a limited potential loss. In case of decreasing prices, the investor is losing money because he has to buy assets at a price that is above market price. In other words, his predictions were wrong and he has to own something he doesn't want or need. That is the reason why investors sell put options in periods of stable prices or only when they are extremely sure that prices won't fall in next period of time.

3.3.1. Vertical spread strategies

Complex option strategies are strategies of buying or selling options in combination with futures contracts. Options in combination with other options can create a so called spread or combination of positions that are practically free of risk. Complex option strategies are a vertical bull spread and vertical bear spread. A vertical bull spread is employed when the investor is bullish and he expects an increase in price. A vertical bear spread is employed when the investor is bearish and he assumes that the price of the underlying asset and futures contract will fall.

3.4. Stable market strategies

In conditions of stable prices, potential profit is lower, but the risk is minimal. These strategies include strategies such as selling a straddle, buying a straddle, writing (selling) a covered put option and buying a covered call option. The strategy called selling a straddle is employed when a neutral trader expects that the price of the underlying asset and the price of a futures contract will be almost unchanged comparing to the current price, without sudden rises or falls. The risk is unlimited. If the price of the futures contract falls out of the established margins, an investor will lose money, as long as the price is out of these margins, and the profit is limited to the amount of received premium. If futures prices do stay stable, the investor (seller of a put option) will make a profit if the buyer of the put option lets his option expire (**Lazibat, 2001**).

The strategy called buying a straddle is employed when the investor believes that the price of the asset and the price of a futures contract will rise and fall during the period until the expiration of the option. In other words, he believes that the trend of sudden increase or decrease of the prices will occur and he will make a profit. Risk is limited to the amount of paid premium. If the price of a futures contract goes out of the established margins, an investor will make a profit as long as the price is out of these margins. If the futures market is stable, an investor (seller of the call option) will make a profit, which is equal to the amount of the premium because in that case, the buyer of the option will let the option expire (**Lazibat, 2001**).

The strategy of selling a covered put option is employed when the investor is extremely optimistic and his goal is to achieve a profit from an expected increase in futures prices (profit is reduced in the amount of a paid premium) and with a known level of risk. Risk is limited to losses in the option's time value with an added amount of the out-of-the-money put option. Profit is unlimited. If futures prices rise, the investor will buy a futures contract. In order to reduce the risk, he will also buy an option for the same contract. By exercising the put option (selling), the investor will assume a short position in the futures market. Since the investor used to have a long position and he used the put option, his positions will be closed both on the options market and the futures market. The profit in this kind of strategy is the difference between the profit in the futures market and the loss in the options market. The strategy of buying a covered call option is employed when the investor is extremely pessimistic (bearish). The investor's goal is making a profit from an expected decrease in futures prices and for an established level of risk. The risk is limited to the loss of the option's time value with the added amount of out-of-the-money call option. Profit is unlimited as long as the futures contract price rises. Profit is reduced only by the amount of the premium that an investor paid for a call option which serves as insurance. If futures prices fall, the investor takes up a short position in the futures market. In order to limit the risk, he will buy a call option for the same contract and by exercising this contract, he will take up a long position in the futures market. This way, an investor's obligations are closed in both markets and the profit equals the difference between the options and the futures markets (**Lazibat, 2001**).

3.5. Energy swaps

Energy swaps appeared on the market in the 1980s and they are bilateral agreements to exchange future cash flows according to some agreed upon formula. A standard swap represents an exchange of cash flows, one

at a fixed rate and the other at a floating rate. Swaps were not traditionally traded until they were introduced on the NYMEX in 2002. NYMEX swaps are bilateral with secret commissions, while the exchange provides protection from failure by guaranteeing both sides a transaction. A participant must pay margins and prices of contracts which are determined daily in the market (**Dahl, 2004**).

4. Current conditions in futures and options markets

Crude oil futures contracts are traded at the NYMEX and the TOCOM (Tokyo Commodity Exchange) exchanges. By specification of the contract, in the NYMEX exchange, crude oil markers Light Sweet and Brent are traded, and in the TOCOM exchange, the crude oil marker Dubai/Fateh is traded. The size of the futures contract for crude oil in NYMEX is 1000 barrel (1barrel - 159 liter), and the size of the futures contract in the TOCOM exchange is 50 000 liter (**URL 2**). When observing total energy contracts traded on NYMEX in 2015, the volume of crude oil futures and options represent 50% and 60 % (**Kyriakou et al., 2016**).

Current crude oil futures contracts prices are shown in **Table 2**. It is noticeable that the last price of the crude oil futures contract for delivery, for example in August 2016, is $36.56/bbl, which is $0.82 less than the average price of the previous trading day. The price of the same contract on opening day was $37.12. Since the difference between the highest and lowest price of the futures contract for delivery in August 2016 is $1.12, from this difference a trader can make a maximum profit of $1.12 in total. His profit is reduced for the amount of the margin that had to be paid in advance.

Crude oil options are traded at the NYMEX exchange, where accompanying futures contracts include a quantity of 1000 barrels of crude oil per contract. For example, for the American option, the minimum floating price is $0.01/bbl and options trading ends three days before the end of trading with futures contracts on which options are based. **Table 3** shows prices of option contracts with maturity in July 2016, whose accompanying futures contract has the price of $35.8/bbl (**Table 2**). With an increasing price of the call option, or a decreasing price of the put option, the strike price of the option rises. If the price of the oil for delivery in July goes up 20 %, to the amount of $42.96/bbl, the call option will be in-the-money. Also, if the oil price goes down 20 %, the put option will be in-the-money. Depending on the oil price, the holder of the put or call option can sell his option or let it expire and in that case, he loses only the amount of the premium which was paid for the option.

Kang et al. (**2013**) in their work point out the importance of predicting petroleum futures prices volatility. Volatility is a component of the price connection between the spot and futures markets, a jump in energy futures markets, risk management and option pricing formulas for futures contracts. In the same paper, the authors compared the dynamics of futures prices of WTI crude oil, heating oil #2 and unleaded gasoline. The results suggested that "gasoline prices have more pronounced short-run dynamics relative to those of WTI and heating oil prices, which are affected by market shocks." (**Kang et al., 2013**)

In their crude oil price analysis, **Kyriakou et al.** (**2016**) state that supply is inelastic, which means that a small change in demand can lead to abrupt price changes. They also concluded that, even though most petroleum products are affected by seasonality effects, the crude oil market doesn't reflect seasonality "in the term structure of futures prices." (**Kyriakou et al. 2016**)

For benchmarks WTI and Brent, the futures-equivalent option open interest is much higher than a futures contract. The highest prices volatility occurred in 2001 (after 9/11), 2008-09 (oil prices peak in the summer of

Table 2 Futures contracts prices with delivery in 2016 (**URL 5**)

month	last price ($)	change in price ($)	average price on the last day of trading	price at opening ($)	highest price	lowest price	number of contracts	upper/lower price limit ($)
March 2016	29.72	-1.05	30.77	30.6	30.73	29.05	69629	no limit
April 2016	31.96	-0.97	32.93	32.7	32.99	31.34	481836	41.75/21.75
May 2016	33.62	-0.93	34.55	34.37	34.62	33.04	108246	43.39/23.39
June 2016	34.8	-0.96	35.76	35.57	35.81	34.3	70880	44.59/24.59
July 2016	35.8	-0.86	36.66	36.4	36.72	35.25	28923	45.50/25.50
August 2016	36.56	-0.82	37.38	37.12	37.4	36	13417	46.22/26.22
September 2016	37.18	-0.84	38.02	37.71	38.09	36.65	11964	46.87/26.87
October 2016	37.66	-0.95	38.61	38.42	38.44	37.38	4036	47.46/27.46
November 2016	38.34	-0.82	39.16	38.98	39.16	37.9	3823	48.01/28.01
December 2016	38.73	-0.94	39.67	39.51	39.754	38.34	32593	48.52/28.52
January 2017	39.27	-0.85	40.12	40.01	40.05	38.87	1678	48.98/28.98

Table 3 Prices of options contracts with maturity in July 2016 (URL 5)

Call option (average price of the last day of trading)	Put option (average price of the last day of trading)	Strike price ($)
5.6	3.1	33.00
5.52	3.31	33.50
5.04	3.54	34.00
4.77	3.77	34.50
4.52	4.02	35.00
4.27	4.27	35.50
4.04	4.54	36.00
3.81	4.81	36.50
3.59	5.09	37.00
3.39	5.38	37.50

2008 and prices collapse in the end of 2008 and early 2009) and August 2011 (developed countries debts). In the period from late 2008 to Spring 2009, Brent's price went up more than WTI's price and "their price spread became very volatile." (**Robe et al., 2016**)

On the other hand, due to abundant crude oil supplies in North America, volatilities were relatively low in the period from mid-2012 to October 2014. It can be concluded that the relationship between oil price volatility and OPEC's spare oil output capacity is inverse (the market can withstand short-time supply disruptions better with greater spare capacity) (**Robe et al., 2016**).

The phenomenon of unconventional oil production in the USA caused an environment of volatile prices in 2014 since many world oil producers started to compete in oil production (**Strpić et al., 2017**).

As mentioned in the introduction, the largest consumers are not necessarily the biggest producers and reserves and production are unevenly distributed. That's why it was necessary for countries to develop different fiscal regimes in order to regulate the relations, control the production and to define the type of profit sharing. Fiscal systems can be concessionary and contractual and countries can choose to establish a state-owned company, to offer concessions to bidders or they can choose to implement a combination of the two. In that case, the national company is a partner and as such takes part in the project (**Karasalihović Sedlar et al., 2017**).

5. Conclusions

Energy is often thought to be a risky business because of many risks and complications that can appear from the moment of bringing the product in the market to the time of selling the product. The occurring risks can be technical, economic, political, geopolitical and other. Except for energy economy risks, financial risks also need to be taken into account. Financial risks relate to possible losses due to changes in the value of financial assets issued by energy companies. These risks are market, credit, liquidity, operational and legal risk. Because of the high volatility of energy prices, energy companies eliminate the risks or minimize them by using energy financial derivatives through futures contracts and options. With futures contracts, by taking long or short positions, the futures price of an energy product can be limited when buying or selling. The advantages of futures markets are price transparency and information on the expected product prices. Options contracts enable another way of controlling financial risk in energy markets, and they give the holder of the option the right to buy or sell a futures contract for energy commodity at some predetermined price. Volatility of energy sources and yield prices is a market risk that needs to be processed in some way. The risk can be completely eliminated, limited or sometimes an unusually high risk can be taken up for some profit, and the futures and options markets make that possible.

6. References

Dahl, A. C. (2011): Energy Economics and International Energy Markets. 730 p.

Day, T. E., Lewis, C. M. (2004): Margin Adequacy and Standards: An Analysis of teh Crude Oil Futures Market. Journal of Business, 77, 1, 101-135.

Gardijan, M. (2010): Strategije trgovanja opcijama (*Strategies of options trading*). Ekonomski pregled, 62, 5-6, 311-337. (*in Croatian*)

Kang, S. H., Yoon, S.-M. (2013): Modelling and forecasting the volatility of petroleum futures prices. Energy Economics, 36, 354-362.

Karasalihović Sedlar, D., Barbir, G. Brkić, V. (2017): Types of fiscal regime in hydrocarbon exploration and production. The Mining-Geology-Petroleum Engineering Bulletin, 32, 1, 45-53.

Kyriakou, I., Pouliasis, P. K., Papapostolou, N. C. (2016): Jumps and stochastic volatility in crude oil prices and advances in average option pricing. Quantitative Finance, 16, 12, 1859-1873.

Lazibat, T., Matić, B. (2001) Strategije trgovanja opcijama na terminskim tržištima (*Strategies of options trading on futures market*). Ekonomski pregled, 52, 11-12, 1317-1344. (*in Croatian*)

Maslyuk, S., Smyth, R. (2009): Cointegration between oil spot and future prices of the same and different grades in the presence of structural change. Energy Policy, 37, 5, 1687-1693.

Polanco-Martinez, J. M., Abadie, L. M. (2016): Analyzing Crude Oil Spot Price Dynamics versus Long Term Future Prices: A Wavelet Analysis Approach. Energies, 9, 12, 1089-1107.

Robe, M. A., Wallen, J. (2016): Fundamentals, Derivative Market Information and Oil Price Volatility. Journal of Futures Markets, 36, 4, 317-344.

Strpić, K., Miličević, M., Kurevija, T. (2017): Development of Tight Oil Resources in USA: Exploitation Costs and Effect

of Macroeconomic Indicators in Volatile Oil Price Environment. The Mining-Geology-Petroleum Engineering Bulletin, 32, 2, 1-12.

Internet sources:

URL 1: http://canadianfuels.ca/userfiles/file/Economics%20fundamentals%20of%20Refining%20Dec18-2013-Final%20ENG-1.pdf (accessed 18th January 2016)

URL 2: www.theoptionsguide.com (accessed 8th January 2016)

URL 3: http://www.tradingeconomics.com/commodity/crude-oil (accessed 7th January 2016)

URL 4: https://www.eia.gov/todayinenergy/detail.cfm?id=9911 (accessed 10th January 2016)

URL 5: www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude_quotes_globex_options.html?optionExpiration=M6 (accessed 10th January 2016)

SAŽETAK

Terminska i opcijska tržišta ugljikovodika

Tržište energetskih mineralnih sirovina predstavlja kompleksne odnose ponude i potražnje dobara koje ovise o velikome broju čimbenika i rizika koje nose sa sobom. Rizici koji se pojavljuju mogu se podijeliti na tehnološke, ekonomske, političke, geopolitičke i druge. Tehnološki rizici mogu se javiti u svim segmentima poslovanja od istraživanja do transporta. Energetski ekonomski rizici uključuju moguće gubitke zbog, primjerice, pada cijena sirove nafte, porasta troškova za eksploataciju nafte, požara u rafineriji i sl. Osim energetskih ekonomskih rizika u obzir je potrebno uzeti i financijske rizike. Financijski rizici odnose se na moguće gubitke zbog promjena vrijednosti financijske imovine koju su izdale energetske kompanije, a mogu se podijeliti na: tržišni rizik, kreditni rizik, rizik likvidnosti, operativni rizik i pravni rizik. Zbog velike promjenjivosti cijena energije energetske kompanije rizike eliminiraju ili smanjuju na najmanju moguću mjeru energetskim financijskim derivatima, i to terminskim ugovorima te opcijama. Specifičnosti energetskih tržišta leže u nerazmjernoj geografskoj distribuciji rezervi energenata i eksploatacije s jedne te potrošnje energenata s druge strane. Tržišta nafte u svijetu, iako su zbog trgovine određenim markerima geografski lokalizirana, čine jedinstveno globalno tržište nafte sa sve manjim cjenovnim razlikama ponajprije zbog transportnih mogućnosti dobave nafte. Razvojem tehnologije ukapljivanja plina (UPP) sve je veći pritisak i na plinska tržišta i njihovu integraciju u globalno tržište, što je jedna od trenutačnih inicijativa unutar EU-a, iako su još uvijek znatne cjenovne razlike na pojedinim plinskim tržištima u svijetu (Sjedinjene Američke Države, Jugoistočna Azija). Razvoj globalnih energetskih tržišta omogućen je razvojem trgovine terminskih i opcijskih ugovora za trgovinu energentima koji su zamijenili prethodne bilateralne dogovore o kupoprodaji energenata između proizvođača i potrošača. Terminski su ugovori standardizirani ugovori kojima kupac pristaje kupiti određenu količinu robe (npr. sirove nafte) po određenoj cijeni s isporukom na neki datum u budućnosti. Prednosti su terminskih tržišta cjenovna transparentnost i informacije oko očekivanih cijena proizvoda. Opcijski ugovor sporazum je između prodavača i kupca koji kupcu ugovora daje pravo na kupnju ili prodaju određene robe po određenoj cijeni u budućnosti. Cijenu opcije određuje cijena temeljne imovine, cijena iskorištenja, rizik imovine, vrijeme dospijeća te kamatna stopa. Kupci i prodavači mogu upravljati rizikom promjene cijene kupnjom ili prodajom terminskih i opcijskih ugovora. Rizik se može potpuno eliminirati, ograničiti ili se katkad može preuzeti neuobičajeno velik rizik, za neku naknadu, što omogućuju terminska i opcijska tržišta koja su analizirana u radu kao i strategije trgovanja na njima.

Ključne riječi:
terminski ugovori, opcije, tržišni rizici, tržište nafte, tržište plina

Author(s) contribution

Ante Nosić mostly dealt with oil and gas futures market, **Lucija Jukić** contributed to the part related to options market, while **Daria Karasalihović Sedlar**, aside from proposing the topic and providing guidelines for the manuscript, described current conditions in futures and options markets.