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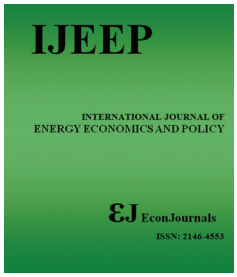

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The Crude Oil Price and Speculations: Investigation Using Granger Causality Test

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ABSTRACT

This paper examines the up normal move of crude oil prices in the last two decades and tries to relate it with the speculative trading of crude oil in the future markets. The speculators were in the centre of attention during the recent large price moves on the oil market. In this paper we attempted to empirically examine the way, oil speculators operate using the methodology of granger causality. We worked with 4 variables - the price of oil Brent, number of active oil rigs, weekly changes in crude oil stocks and financial positions of investors. Our results show that, on the time period we covered, there exist bidirectional granger causality between oil price and investment positioning of money managers. However we also found the existence of strong Granger causality running directly and indirectly from the fundamental indicators (number of oil rigs and oil stocks) towards money managers financial positions on the oil markets. This finding suggests that even if financial investors have impact on the price of oil, their actions are fundamentally sound.

Keywords: Granger Causality, Oil Price, Speculation
JEL Classifications: Q41, Q43

1. INTRODUCTION

The unprecedented surge of crude oil prices in the period 2005–2008 and the sharp decline in the next sixth months after that period has not been caused by fundamentals in the oil market. We are aware of the fact that crude oil prices are one of the most volatile among the prices of all primary commodities. But the huge movement that happened in crude oil prices in the periods 2005–2009, 2010–2012 and 2014–2016 cannot be simply explained by supply and demand. Many analysts attributed the sharp move of crude oil price to speculators in the futures markets.

Indeed, the determinants of crude oil prices are not only supply and demand, but also other factors which directly or indirectly affect the supply or demand and in the end the crude oil price. One of these factors is the speculation in the futures markets. While many analysts, traders and producing or importing countries consider the speculation in the futures markets to be a negative factor for crude oil price development, others sees it as a stabilising factor in the crude oil markets. For instance, according to Errera and Brwon (2002)…"Speculations contribute greatly to the efficient pricing of futures contracts. Ultimately, the price of a futures contract must be related to its true value - true value that is associated with the cash price and carrying charges. Speculators acting in their own self-interest cause the prices of futures contracts to be close to their true worth."

What does the speculation mean? It is legal or illegal activity? Of course in our point of view the speculation is legal trading activity in the future market while there are some legislation regulating these activities. Whether these trading activities are executed within given ethical standards remains questionable.

According to Errera and Brwon (2002) Speculation may be thought of as any risky activity undertaken solely for the purpose profit. Given the broad definition, speculation may be divided into two categories - position trading and spread trading. Position trading consists of outright long or short positions in future contracts. The aim of position trading is to profit from changes in the level of prices of futures contracts. Spread trading consists of both a

long and a short position in different contracts of the same related commodities. The general definition of speculation is provided in Kilian and Murphy (2013) who note that anyone buying crude oil not for current consumption, but for future use is a speculator from an economic point of view.

The objective of this paper is to identify the role of speculation in futures market by empirically examining the way oil speculators operate using the methodology of granger causality. In other words we tried to examine, whether the general knowledge that attributes still greater share of oil price movements to decisions of these so called money managers is valid. This paper is divided into 6 sections. After the introduction, the second section is about the development of crude oil prices in the last years. The literature review is the content of the third section and is followed by the methodology of our analysis and its results which are in the fourth and fifth sections.

2. DEVELOPMENT OF CRUDE OIL MARKET IN THE LAST YEARS

After two decades of relatively quiet period on the oil markets at the end of 20th century, the interest in oil price developments resurfaced as prices started to experience a steady upward trend at the beginning of this millennium. Since 2005, this upward movement became more rapid and then, in the course of 2008, oil prices climbed to unprecedented highs of USD 140 per barrel in July, only to fall dramatically in a very short period of time to a low of US 40 per barrel in December 2008. Since the end of 2008, oil prices have picked up again, just to lose momentum in 2013 dropping below 30 USD/bbl in January 2015 and prompting OPEC and Russia into actively managing the oil market starting November 2016.

The article analyses the development of oil price during the recent 3 years. These years were characterized by OPEC actively intervening on the oil market after being relatively quiet during the previous period of high oil prices. The cartel shocked the oil market in 2014 when it announced that, despite a surge of the non-OPEC supply that had already pushed oil prices down, it would not make any reductions in its production, and the oil prices had dropped significantly. In 2015 OPEC increased production by 1.56 kbl/d and more than offset the lower output growth in OECD countries caused by lower oil price as well as demand growth. Aggregate demand growth in 2015 reached 2 mbl/d, and was accompanied with an 2.9 mbl/d increase in supply, resulting in a price drop from 78.44 USD/bl in November 2014 to 37.72 USD/bl at the end of 2015. During the following year, 2016, a gradual supply-demand balancing of the oil market began. Demand for oil increased again by 1.6 mbl/d, but production increased by only 0.4 mbl/d. As in 2015, incremental demand came almost exclusively from oil importers, with India (0.3 Mb/d) and Europe (0.3 Mb/d) having unusually strong growth. On the other side, the growth in demand in China (0.4 Mb/d) and the US (0.1 Mb/d) was quieter compared to previous year. Overall expectations for market reaching supply demand balance have been strengthened in November 2016 by an agreement between OPEC, supplemented by 10 other producers headed by Russia, who have agreed to reduce production by 1.8 mbl/d for 6 months beginning January 2017. In response to this announcement, the average monthly oil prices rose by 16% to 54.07 USD/bbl in December 2016. This growth trend slowly continued during the first two months of 2017, when prices reached their average monthly maximum of 54.89 USD/bbl so far this year. However, during this period, oil market participants notified the production recovery on the US oil market, where the average WTI marker price has reached 53.4 USD/bbl, which has stimulated shale oil production. The number of active drilling rigs increased to more than double the minimum of the summer 2016 (662 vs. 316), and US production alone increased three months from the beginning of the OPEC production constraint by 300 kb/d to 9.1 mbl/d (EIA has been projecting an increase in production up to a level of 9.9 mb/d by the end of the year). In addition to the increase in US production, a significant part of the production from Libya and Nigeria returned to the market, previously disrupted by continuing armed unrests, and these countries were not part of a group that was committed to reducing its production under OPEC and Russia agreement. Production of Libya has increased from an average of 360 kb/d in December 2016 to June 950 kb/d and Nigeria's production has increased by more than 200 kb/d from December's 1600 kb/d. This increase in supply, together with the fact that also OPEC countries that have committed to reduce their production in the beginning of 2017 continued to export stocks stored from the previous periods led to the fact that oil stocks in the United States and OECD countries, which have become the most watched variables even slightly increased. The commercial oil stocks reported by EIA grew by 105 mbl in 2015. The growth in 2016 was much more modest with increase of only 28 mbl. And during first half of 2017 only 16 mbl growth in crude oil stocks was seen which represented 44% and 72% decline in growth of crude oil stocks during the same period in years 2016 resp. 2015.

During this period oil price went through several periods of sudden and heavy moves which were often attributed to changes in trading positions of hedge funds and other money managers. According to FCC reports they were responsible on average for 25% of the Open Interest of the market dealing with crude oil trading, ranging from 20 to 30% during the observed period. This translates into 867 thousands crude oil contracts (representing 896 million barrel of oil) they were holding on average (with range from 693 thousands to 1060 thousands of contracts). In other words, on average money managers on daily basis operate roughly with 10 days worth of world oil consumption. For our purposes we did not follow the absolute volumes of barrels held by speculators the ratio of long to short positions (L/S ratio) that better describes the expectations of the market participants. During the 2015 the highest price of oil around 67 USD/bbl from May coincide with the L/S ratio of around 4. After then the expectations supported by stocks build ups led to slump in L/S indicator and fall in oil prices to level of 30 USD/bbl. Here the momentum changed and oil speculators gradually built up of their long positions to the level where their ratio topped 3:1 and oil price grew moderately to around 50 USD/bbl. The significant increase of bullishness of oil speculators then came with the OPEC announcement of cuts and L/S ratio reached its peak value within the observed period of almost 6 at the end of February. However this happened during the first quarter of

2017 during which crude oil stocks increased by 56.5 mbl which was by 9 mbl more than during 2016 and price of oil did not rise. The bearish fundamentals consequently led do sell off and L/S ratio decreased significantly, reaching just 1.46 at the end our observation period.

3. LITERATURE REVIEW

There is no consensus as to the causes of oil price movements in recent years. A number of studies attributed volatility to such supply and demand factors as turmoil in oil-producing countries, reduced production in some major oil fields, and the growth of demand from China, India, and industrializing middle-income countries (Jickling and Austin, 2011) and recently the rise of shale oil in the USA. A frequent argument has also been that increasing investment flows from financial investors have affected prices (Dicker, 2011). Other analysts have sharply criticized those claims.

Before we commence with the review of the scientific literature on this subject we provide quick glimpse into the workings of the oil future market to provide some background on this subject to the reader. Crude oil futures contract is an agreement to buy or sell 1000 barrels of oil at some future date at a price set today. Thus, the contract gains or losses value as prices fluctuate[1]. A long position in futures may be described as a bet that prices will rise; a short position is a bet that they will fall. Each futures contract has a long and a short side—whatever one trader gains, the other loses. Hedgers use futures not to bet on the price, but to avoid price risk. For example, a long contract in effect provides insurance to an oil refinery against an increase in the price of crude oil. If prices rise, the hedger will pay more for oil on the physical (or "spot") market, but appreciation in the futures position offsets the price increase. Thus, the firm can use futures to lock in the price that prevailed when it entered into its position. In practice nearly all contracts are settled for cash, without either party taking or making delivery. A trader may exit the market at any time by simply purchasing an offsetting position. That is, the holder of a long contract purchases a short contract with the same expiration date. Most trading is in the contract expiring soonest, called the front month.

Some authors note that fundamentals and more specifically increased demand from fast growing developing countries - which are accounting for larger and larger shares of annual oil consumption growth - are playing an important role (for instance Helbling et al., 2008). While some large developing countries have been growing rapidly for years, and in some cases decades, a combination of rapid industrialization and higher commodity intensity of growth, coupled with rapid income per capita growth, has increased significantly their oil demand. Calvo (2008) argues that excess liquidity and low interest rates have been contributing to the price increases. Low interest rates resulting in the expansion of money supply decreased the demand for liquid assets by sovereigns like China, Chile or Dubai. Both effects would eventually lead to an increase in prices. But not all prices would move at the same time as some prices are more flexible than others. Among the most flexible, according to Calvo (2008), are the commodity prices. A similar argument has been made by Frankel (2005; 2006).

In addition to these more fundamental based explanations, some studies have noted that speculation might also be behind the upward movement in commodity prices. The role of speculators in futures markets has always been a source of both interest and controversy in recent years. The traditional speculative stabilizing theory of Friedman (1953) suggests that profitable speculation must involve buying when the price is low and selling when the price is high. The traditional theory predicts that irrational speculators or noise traders, who trade on the basis of irrelevant information, will not survive in the market place. Such view is for instance confirmed in Lombardi and Van Robays (2011) who found that speculative trading in futures markets may affect spot oil prices significantly, but their overall importance is limited over time. Such views are however being challenged by theories of noise trading, herding behaviour and speculative bubbles. Shleifer and Summers (1990) and DeLong et al. (1990) for instance show that noise traders might have an impact on prices if they hold large share of assets regardless of their survival in the long run. Such views have gained increasing prominence, due to the coincident rise in crude oil prices and the increased numbers of financial participants in the crude oil futures market from 2000 to 2008. Indeed, over the last decade, the volume of trading in financial instruments linked to oil (and in general commodities) has increased sharply on both commodity exchanges and over-the-counter markets. For instance, the open futures positions held by financial traders (hedge funds and non-registered participants) grew sharply - from about 45,000 contracts in the second half of 2000, to more than half a million futures in the first 8 months of 2008. As a result, the market share of financial traders has more than doubled, from <20% of all open futures and futures-equivalent option positions in 2000 to more than 40% in 2008.

To sum it up, the recent literature points towards several factors which may have driven oil prices upwards. However, at the same time, the literature remains inconclusive as to the relative importance of these factors. In particular, there is no consensus as to the relative weight that should be attributed to speculation versus (i.e., supply and demand) fundamentals in driving oil prices (Vansteenkiste, 2011).

Kilian (2009), Kilian and Murphy (2012), and Baumeister and Peersman (2012), used data on oil inventories to identify the speculative demand component of the real oil price. Their identification strategy rests on the assumption that unobservable shifts in expectations about future oil prices must be reflected in shifts in the demand for above-ground crude oil inventories Their main finding is that speculative demand played only a modest role in the real oil price build up of 2003–08. This result was later confirmed by Kilian and Lee (2013) and Eiloth (2009). Juvenal and Petrella (2011) instead have found a substantial role for financial speculation (Adam et al., 2015; Aydogan and Berk, 2015; Wei and Chen, 2016; Ojikutu et al., 2017; Adam et al., 2018).

1 A contract to buy oil (called a long contract) gains value if the price rises, because the holder is entitled to buy at the old, lower price. Conversely, a short contract requires the holder to sell at today's price, and gains value if prices fall, because the holder may sell at above the market price.

Knittel and Pindyck (2013), using a reduced-form approach, assessed whether speculation in (mainly) oil futures markets, as a driver of price changes, is consistent with the data on production, consumption, inventory changes, and spot and futures oil prices (given reasonable assumptions about elasticities of supply and demand). They showed that although they could not rule out the possibility that speculation had any effect on oil prices, speculation as an explanation for the sharp changes in prices could be ruled out for the period since 2004. They argued that, unless one believes that the price elasticities of both oil supply and demand are close to zero (a conjecture initially put forward by Hamilton, 2009), the behaviour of inventories and futures-spot spreads are simply inconsistent with the view that speculation was a significant driver of spot prices over that period. Across their sample, speculation decreased prices on average or left them essentially unchanged and reduced peak prices by roughly 5%.

Another strand of the literature has instead focused on a narrower definition of speculation which is mainly related to the possible malfunctioning of commodity financial derivative markets (Fama, 1998). Masters (2008) blamed the oil price spike of 2007–08 on the actions of investors who bought oil futures not as a commodity to use but as a financial asset. He argued that by March 2008, commodity index trading funds holding a quarter of a trillion U.S. dollars' worth of futures contracts were able to push the spot price up dramatically—however, he did not provide any coherent testable model. Alquist and Kilian (2010), Liu and Tang (2010), and Tang and Xiong (2010) found a structural break in the spot oil price post-2004. The latter attribute it to institutional investors entering the futures market, which then led the spot price to rise higher, moving more closely with the risk premium of the stock market.

To rationalize deviations from fundamentals, Singleton (2011) explored the impact of active investor flows and financial market conditions on returns in crude oil futures markets. Singleton (2011) showed how financial and informational frictions and the associated speculative activity induce prices to drift away from fundamentals and thus showed increased volatility. He found significant empirical support that financial activities are likely to drive the spot oil price away from fundamental values, primarily through investor flows influencing excess returns from holding oil futures contracts of different maturities. Various micro studies using confidential data of the commodities future trading commission, however, have struggled to find evidence that non-commercial players have been able to influence oil price movements (Beidas-Strom and Pescatori, 2014).

According to Ederington et al. (2011) OPEC plays an important role in terms of world oil supply. In most macro/global models of the oil market OPEC supply is a crucial ingredient. OPEC in principle can influence oil prices by managing production quotas (Wirl and Kujundzic, 2004; Kaufmann et al., 2008) and/or capacity utilization (Kaufmann et al., 2004; 2008). Kaufmann et al. (2004) study the time series behaviour of real oil prices, OPEC capacity utilization, OPEC quotas, the degree to which OPEC exceeds its production quotas and OPEC stocks of crude oil. The authors study quarterly data for the period 1986 through 2000 and find the OPEC related variables Granger causes oil prices during the sample period. As such it is probably no surprise that announcements by OPEC of policy changes are greeted by oil markets much like announcements of U.S. Federal Reserve policy changes are greeted by financial markets. Demirer and Kutan (2010) used event study tests to examine the effects of OPEC announcements on crude oil market activity in the U.S. Their sample consists of 63 OPEC press releases from the period 1983 to 2008. The empirical approach involves the measurement of cumulative daily abnormal log price changes in the spot and futures markets at the time of and around the announcements using chosen benchmarks to estimate conditional expected changes. Their findings suggested no significant reaction to OPEC production increases in either the spot or futures markets. OPEC announcements of production cuts, however, were associated with significantly negative abnormal returns in the spot and futures markets during the period Day +2 to +20, where Day 0 is the day of the announcement. OPEC announcements that maintain the aggregate production quota are associated with negative abnormal returns in the spot and futures markets in the day +2 to +20 periods. Kilian and Murphy (2010) noted that opponents of the view that speculation caused high oil prices during 2003–2008 often cite a lack of noticeable increases in the rate of inventory accumulation during the same period. However, they pointed out that Hamilton (2009) argues that speculative trading can, in theory, influence oil prices without any change in inventories if the short-run price elasticity of oil demand is zero. Hamilton observed that existing estimates of this elasticity in the literature are close to zero.

Baumeister and Peersman (2009) analyzed changes in oil market dynamics during 1960–2008. The study is motivated by the fact that volatility in crude oil prices increased considerably during this period, while oil production fell substantially. The focus of the study is identifying the source of this puzzle. To this end, they estimated a time-varying parameter Bayesian vector autoregressive model with stochastic volatility in the innovation process. The model identified three types of structural shocks that drive oil prices: Oil supply shocks, oil demand shocks caused by economic activity, and demand shocks specific to the crude oil market. The shocks were identified via sign restrictions to allow for the immediate impact shocks on both prices and production that can vary with time. The main finding is that the oil price volatility puzzle can be attributed mostly to a substantial decrease in the price elasticity of oil supply and demand after the mid-1980s. Thus, market shocks of the same magnitude generated larger and larger price swings due to the steepening of the supply and demand curves. In addition, the analysis indicated that oil prices adjust rather quickly to their long-run equilibrium levels in response to shocks during the entire sample period A study by Guera (2008) which included an analysis of the time series response of a shock to investment (measured as a shock to oil rig activity) found only a slight impact on oil price changes, 8% of variation in price changes. Most of the studies that examined the relation between oil rig count changes and oil price changes tended to parameterize the model to test whether expected prices influence oil rig activity, but do not allow for feedback from changes in oil rig activity to changes in prices. A good example of this literature is Ringlund et al. (2008) who, like Guerra, concluded that a shock to oil prices has a significant immediate impact on oil rig activity.

We intend to look into the influence the oil speculation have on the oil markets especially in the short term period. We tried to estimate the causal link between speculative trading, movements of price of Brent oil while investigating for the role of supply demand factors regularly reported on weekly basis that are sharply observed by oil traders specifically - EIA weekly statistics on the movements of storage in the US and number of active oil rigs in the USA.

4. DATA AND METHODOLOGY

This article works with four basic time series: Price of Brent oil, the ratio of long to short positions of Money managers of futures oil contracts, reported on weekly basis by FCC, the number of active oil rigs in USA reported by baker Hughes and changes of weekly oil storage reported by EIA. The price of oil is represented by closing price of currently traded front month contract for the day when FCC report is published. We examined the period starting in from 2015 till June 2017 - which provided us with dataset of 128 observations. We focused on this period, because we intended to find out the importance of American shale revolution and speculation on the price of oil during the period of OPEC's effort of active management of the oil markets.

In order to examine the relationship among our variables via pairwise Granger causality test, we need to make sure our data are stationary. The objective of unit root test is to empirically examine whether a series is stationary. We applied ADF unit root test to determine the order of integration of the variables and, therefore, to provide the time-series properties of data. If the series contains a unit root, this means that the series is non stationary. Otherwise, the series will be categorized as stationary. Our data were used in the form of first differences of their logarithmic transformations and they were stationary. Pair wise causality relationship between variables should be tested through the implementation of standard Granger causality test. Granger's (1969) concept of "causality" assumes a different meaning with respect to the more common use of the term. The statement(y) Granger causes (x) or vice versa, in fact, does not imply that (y) and (x) is the effect or the result of (y) and (x), but represents how much of the current (y) and (x) can be explained by the past values of (y) and (x) and whether adding lagged values of (y and x) can improve the explanation. For this reason, the causality relationship between (y and x) can be evaluated by estimating the following regressions:

$$\ln X=\alpha_1+\sum_{i=1}^{m}\beta_i X_{t-i}+\sum_{j=1}^{n}\lambda_j \ln Y_{t-j}+\nu_t$$

$$\ln Y=\alpha_2+\sum_{i=1}^{n}\gamma_i Y_{t-i}+\sum_{j=1}^{n}\delta_j X_{t-j}+\varepsilon_t$$

α_1 α_2 - constants; ν_t ε_t - white noise; i, j - lag length; t - time period.

Following this approach, the null hypothesis that (x) does not granger cause (y) in regression (4) and that (y) does not Granger cause (y) in regression (5) can be tested through the implementation of a simple F-test for the joint significance of, respectively, the parameters β_i and γ_i. The above equations were estimated using two lags of each variable which should represent and adequate lag-length over which one series could help to predict the other.

5. RESULTS

Testing for Granger causality requires data to be stationary. Stationarity in strict sense means that probability distributions of data do not change in the course of time (Lukáčiková and Lukáčik, 2008). For practical research the time series can be considered stationary when their mean, variance and covariance do not depend on time. Economic time series often includes trend and are therefore often nonstationary with respect to mean. If this trend is linear simple first differencing the data will restore stationarity. A logarithm transformation of variables is another useful way to obtain stationary data (Lukáčik and Pekár, 2006). It is important to cover non-stationary variables into stationary process. Otherwise, they do not drift toward long term equilibrium (Bekhet and Yusop, 2009). We used Schwarz information criteria to select the lag length. When considering whether to confirm or reject the null hypothesis of unit root existence we used 5% level of significance (Table 1).

We used data in their stationary form; therefore we proceeded with the simple pairwise Granger causality test. We obtained following results. Firstly, at 5% level of significance we found that investments of money managers influenced price of oil (at 10% significance level we even observed bidirectional causality) - meaning that price speculations actively influenced price of oil and to a lesser extent these investment decisions where driven by the price oil itself which would suggest money managers used trend following techniques in their investment decisions (Table 2). However our analysis revealed existence of interesting interrelations of observed variables. The first intuitive, although important, conclusion of our examination is existence of bidirectional causality between number of oil rigs and oil stocks. This can be simply understood as that higher employment of oil rigs will lead to higher oil production and consequently higher stocks. Or looking from a different perspective, low oil stocks could be reason for higher drilling effort. The other important finding is the speculations of money managers (expressed by our long to short ratio of future positions) seemed to be granger caused by changes of crude oil stocks. This chain of causalities brought us to conclusion, that the investments of money managers can at least indirectly (via changes in crude oil stocks) Granger causes the price of oil. Apart from that, we found on 10% level of significance a causality running from number of oil rigs and changes in stocks directly towards oil price which could be identified as further confirmation of our previous results.

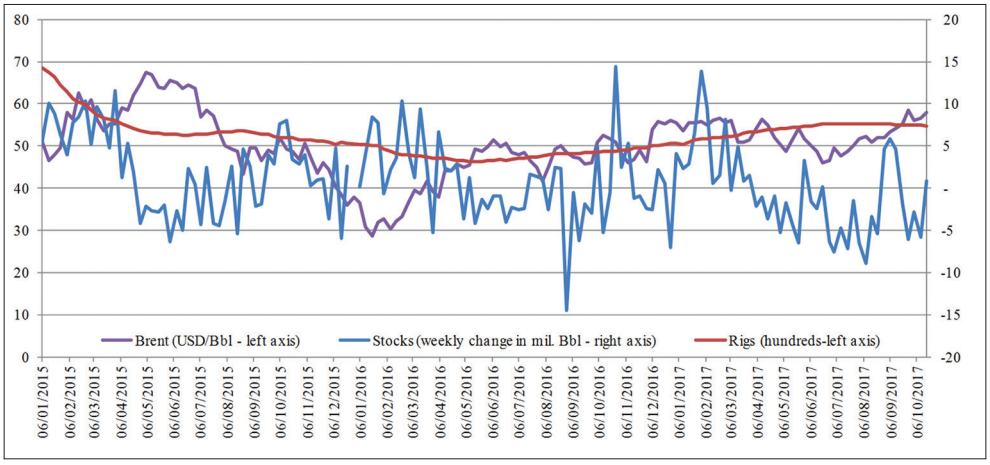
To sum it up, it can be stated that the price of oil is Granger caused by speculation of various investors, but these decisions about these speculations are to large extent driven by the fundamentals

Table 1: Results of ADF unit root test

Variable	ADF test	
	t-stat	P-value
Brent	−12.13562	0.0000
LSratio	−8.160941	0.0000
OilStocks	−14.10479	0.0000
OilRigs	−3.024819	0.0354

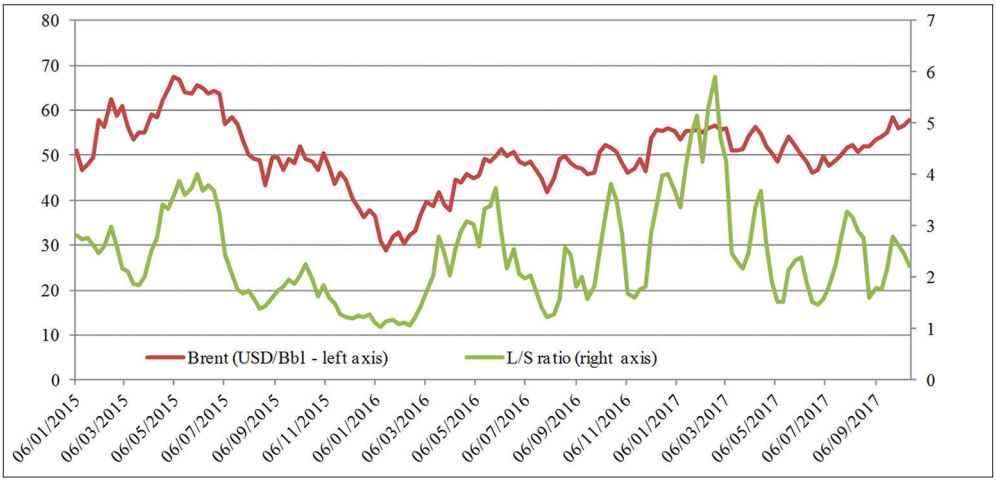
Source: Authors calculations

Figure 1: In response to this announcement, the average monthly oil prices rose by 16% to 54.07 USD / bbl in December 2016.



Source: Authors based on various data collected by Reuters

Figure 2: during the 2015 the highest price of oil around 67 USD/bbl from



Source: Authors based on various data collected by Reuters

on actual oil markets, which basically confirms the claim that the of financial investors is to help markets to function efficiently.

6. CONCLUSION

The price speculators were in the centre of attention during the recent large price moves on the oil market. This is understandable as investment, index and hedge funds become integral part of modern oil trading, even replacing the traditional international oil companies in its role of most important players on this market. In our paper we tried to examine, whether the general knowledge that attributes still greater weight of oil price movements to decisions of these so called money managers is valid. In our article we used the methodology of pair wise Granger causality, which enabled us to determine the direction of causality among individual available variables. In this article we worked with 4 variables - the price of oil Brent, number of active oil rigs, weekly changes in crude oil stocks and financial positions of investors. We chose to focus on the data that are closely observed by market participants on weekly basis, as they represent the most reliable description of fundamentals on the oil market.

The results of our calculations show that on the time period we covered that there is bidirectional Granger Causality between oil price and investment positioning of money managers. This would suggest that money managers are not only causing but also following oil price trends in order to make profit and in this way they exaggerate the range of oil price moves. However we also found the existence of strong Granger causality running directly and indirectly from the fundamental indicators (number of oil rigs and oil stocks) towards money managers financial positions on the oil markets. This finding proves that even if financial investors have impact on the price of oil, their actions are fundamentally sound - in other words, they basically help to the price of oil to accurately express the immediate state of oil market fundamentals. Nevertheless do not infer the moves in oil price are not stronger than they were had the positions of oil speculators were of lesser significance.

7. ACKNOWLEDGMENT

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Table 2: Pairwise granger causality test results

Null hypothesis	F-statistic	P-value
L_S_RATIO does not granger cause brent	4.10860	0.0188
Brent does not granger cause L_S_RATIO	2.77311	0.0665
OIL RIGS does not Granger Cause Brent	2.75550	0.0677
Brent does not granger cause OIL RIGS	0.63058	0.5341
STOCKS does not granger cause brent	2.60761	0.0780
Brent does not granger cause STOCKS	0.27870	0.7573
OIL RIGS does not granger cause L_S_RATIO	0.15650	0.8553
L_S_RATIO does not granger cause OIL RIGS	0.57489	0.5644
STOCKS does not granger cause L_S_RATIO	4.04758	0.0200
L_S_RATIO does not granger cause STOCKS	0.06423	0.9378
STOCKS does not granger cause OIL RIGS	3.42292	0.0359
OIL RIGS does not granger cause STOCKS	3.12103	0.0478

Source: Authors calculations

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