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TRADING ACTIVITY AND PRICES IN ENERGY FUTURES MARKET

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Abstract

This paper aims to examine trading activity and the relationship between futures trading activity by trader type and energy price movements in three energy futures markets –natural gas, crude oil and heating oil. We find that the level of net positions of speculators are positively related to future returns and in contrast net positions of hedgers are negatively related to futures price changes in all three markets. The changes in net positions are relatively more informative compare to the level of net positions in predicting price changes in related markets.

Keywords: Energy Futures, Speculation, Hedging Pressure, Trading Activity

1. Introduction

Sharp price movements of energy prices in the mid-2000s led to concerns by policy makers and regulators. The trading of energy derivatives contracts have begun to grow rapidly over the past decade compare to cash markets (Domanski and Heath, 2007). The coincidence of increased derivatives trading with increasing energy prices has driven studies which examine whether price effects have been augmented by this development in energy markets. Some studies such as Tang and Xiong (2010) argued that increasing participation of financial investors in the futures market trading (i.e., investments in commodity indices) were the large part of the commodity price movements and commodity futures prices are driven by speculative pressures.[1,2,3]

On the other hand hedging pressure theory (Keynes, 1930) states that hedgers who are typically net short on the futures markets offer a risk premium to attract speculators to take a long position and provide liquidity to hedgers and this might result in changed price levels.[4]

In sum, both hedging and speculative pressures assume that changes in futures prices are affected by changes in hedgers' and speculators' open interest positions.

In this paper by employing CFTC’s Commitment of Trader (COT) report, we will examine the relation between futures trading activity by trader type and price changes for selected energy markets and try to answer whether futures trading activities convey valuable

[1] Fattouh *et al.* (2012) provides an extensive survey of the role of the speculation in oil markets.
[2] For example, energy commodities accounted for about one-third of 2015 target weights in Bloomberg Commodity Index with crude oil comprising 15%.
[3] Please note that there are other studies such as Krugman (2008), Kilian (2009) and Wuthisatian (2014) etc. that suggest price movements are originated from fundamentals rather than excessive speculation.
[4] Various studies have documented the effect of hedging pressure on prices such as Bessembinder (1992) and De Roon *et al.* (2000).

information on potential price movements on energy markets. CFTC's COT report publishes information on the positions held by reporting traders. COT report disaggregates open interest into positions held by reporting and non-reporting traders and former category further disaggregated as commercials and non-commercials. Traditionally "commercial category" is viewed as commercial hedgers and "non-commercial" category as speculators.[5] We use net positions of traders as a proxy for trading activity. Examination of trading activity (i.e. both speculation and hedging activity) could help us to determine whether there is an excessive speculation in the US energy futures and the price impact of futures trading activity. Understanding the factors behind these price movements in energy markets will be useful for policy makers and regulators as well as the traders of these markets.

This paper examines the price impact of futures trading activity (both speculation and hedging) on energy prices. The remainder of this article is organized as follows. Section 2 explains the methodology employed in the paper. Section 3 explains the data and presents preliminary analysis of the data. Our results are presented in Section 4 and Section 5 concludes the paper.

2. Methodology

Firstly we will investigate how traders' current positions and the changes in traders' net position impact the futures price movements. In order to do so, following regressions would be estimated

$$\Delta p_{t+k} = \alpha + \beta NP_{t,j} + \varepsilon_t \quad (1)$$

and

$$\Delta p_{t+k} = \alpha + \beta \Delta NP_{t,j} + \varepsilon_t \quad (2)$$

where $\Delta p_{t+k} = p_{t+k} - p_t$ is k period ahead log price changes, k=0,1,4,8,12. For k=0 $\Delta p_t = p_t - p_{t-1}$ is the current change in the log prices. NP is the level of net positions (speculators or hedgers) and $\Delta NP_{t,j} = NP_t - NP_{t,j}$ is the change (in level) over previous j period's net position. In this framework the net of traders' long positions versus their total short positions is interpreted as a measure of their trading activity (i.e., speculative or hedging activities) in the futures markets. The net positions held by hedgers indicated hedging demand.

We also calculate hedging pressure[6] in the markets using following formula in order to determine the extent of hedging pressure in energy markets:

Hedging pressure= Short commercial positions-Long commercial positions/Total commercial positions (3)

Secondly we will calculate Working's T index which measures the adequacy of speculative positions needed to balance the hedging positions held by commercial traders. The T index has a minimum value of 1 when speculation level is equal to the hedging need. According to Working (1960), the speculation activity which exceeds hedging needs is considerate as excessive and excessive speculation could cause price volatility in related markets.

Working's speculative T index is calculated as follows:

[5] We must note that by 2009 CFTC launched a more detailed report of traders called as Disaggregated Commitments of Traders (DCOT) which adds four new categories of large traders (Producer/merchant/processor/user, swap dealers, managed money, other reportables). One drawback of this data set is that it was not available during the surge of commodity futures trading and emergency of new financial participants during the mid 2000s.

[6] There are studies which examine the impact of hedging pressure on the market prices. See Bessembinder (1992), Tien (2002), and DeRoon *et al.* (2000) etc.

$$T = 1 + SS/(HL + HS) \quad \text{if} \quad HS \geq HL \tag{4}$$

or

$$T = 1 + SL/(HL + HS) \quad \text{if} \quad HL > HS \tag{5}$$

where open interest held by speculators (non commercials) and hedgers (commercials) is denoted as follows: SS is speculation short, SL is speculation long, HS is hedging short and HL is hedging long.

3. Data and Preliminary Analysis

Data related to natural gas, crude oil and heating oil futures markets are obtained from U.S. Commodity Futures Trading Commission (CFTC). The nearby futures contracts are employed in this study. Settlement prices and open interest for all contracts are from CFTC database. Contracts used are crude oil (CL), natural gas (NG), heating oil (HO) for the period October 6th 1992 to December 13th 2011. Historical data on the futures trader positions, used in our analysis are extracted from the Commitments of Traders (COT) reports. The futures market open interest positions of market participants are collected every Tuesday and this trader position information released weekly to the public on following Friday since October 1992. The reports contains information on the long and short positions of the three categories (Reportable (Commercials, Non-Commercials) and Non-Reportable) as well as open interest across all maturities of futures contracts. In each market, the CFTC defines large traders. If a trader's position exceeds the reporting threshold then he/she is classified as large trader. Reporting levels are adjusted periodically by CFTC. Aggregate positions in Large Trader Reporting account for 70 or 90 percent of open interest in any given market.[7] The legacy COT report separates reportable traders only into commercial and non-commercial categories. A trader is classified as a commercial trader if trader uses derivatives for hedging against commodity price risks in their businesses. If a trader takes futures positions for reasons other than hedging, the trader is regarded as noncommercial. Following the literature we interpret the commercial traders as commercial hedgers (who were involved handling the physical commodity) and non-commercial traders as speculators.

Figure 1 presents nearby futures prices for the data period. Descriptive statistics and ADF Augmented Dickey Fuller (ADF) tests for the futures price changes and the net positions held by speculators and hedgers (i.e., trading activities) for natural gas, crude oil and heating oil futures markets by trader type are reported in Table 1. ADF test results suggest prices I(1) and net positions tend to be stationary (i.e., I(0)) with the exception of natural gas markets. The means of hedgers' net positions found to be negative for crude oil and heating oil market and positive for natural gas markets. That means on average hedgers are net short on crude oil and heating oil markets and they are net long on natural gas markets. Interestingly, net open positions of speculators are larger than the net open positions of hedgers in natural gas market on average. On the other hand, net open positions of hedgers and speculators are roughly same in crude oil market. However, large standard deviations in natural gas and crude oil markets indicate that substantial variations in net positions. The average weekly price changes are positive for all three markets. This suggests sustained period of upward movement in selected energy futures markets.

[7] Classification of commercials into hedgers, non-commercials into speculators and non-reportables into small traders is done by CFTC. Trader designations may be inaccurate. Furthermore, this classification might be misleading with the growth of commodity index investing

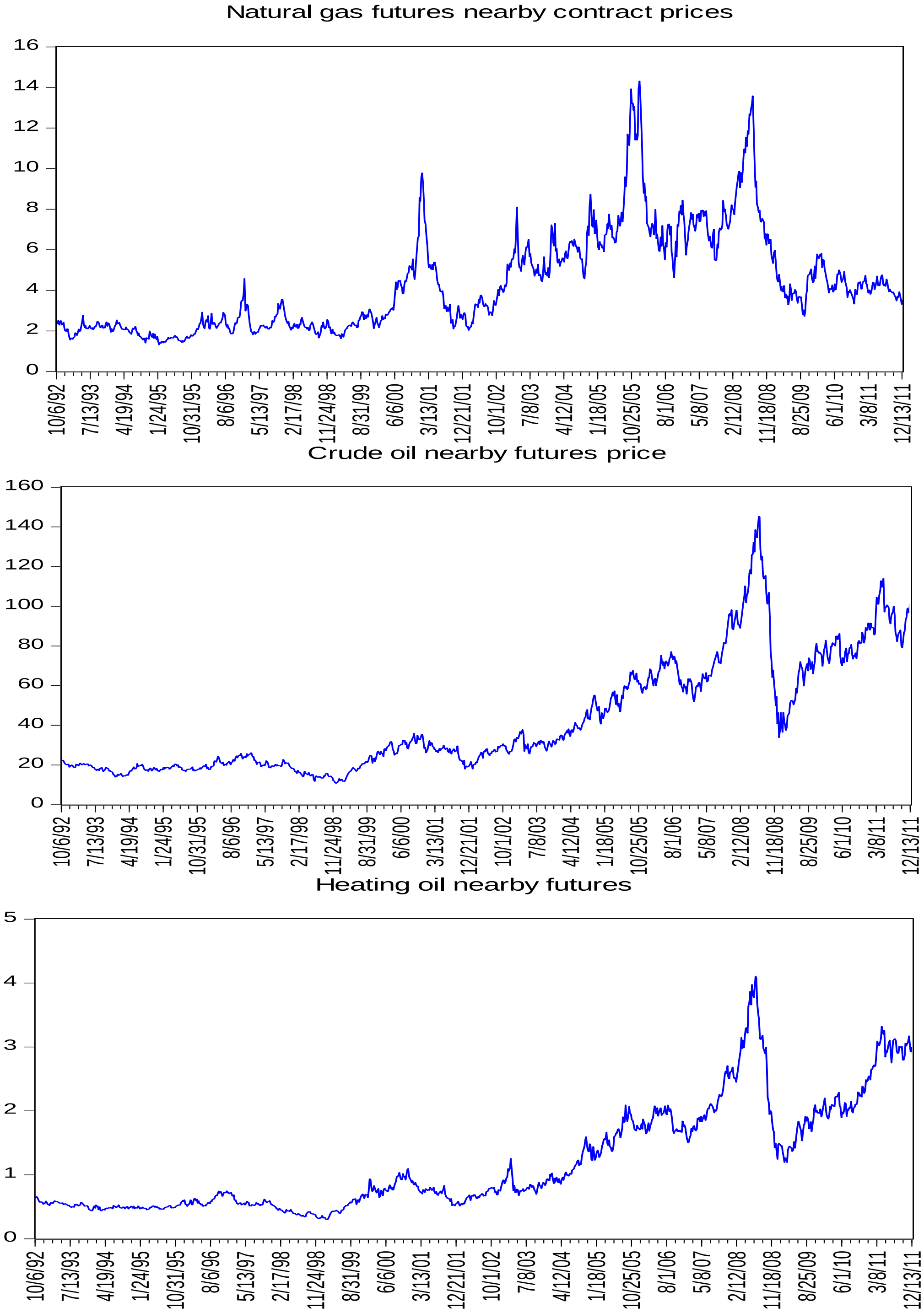

Figure 1. Nearby futures prices

Table 1. Summary statistics

	Natural gas	Crude oil	Heating oil
Net Positions *Hedger*			
Mean of NP	1.1693	-2.7886	-1.8841
Median of NP	-0.8222	-1.8246	-1.8050
St. dev of NP ADF Test of NP Mean of ∆NP	6.1693 -2.2209 0.0149	6.1602 -4.6700* -0.0192	1.6561 -7.4610* 0.0001
Mean of |∆NP|	0.6268	1.2160	2.0458
Net Positions *Speculator*			
Mean of NP	-3.5489	2.7223	0.7658
Median of NP	-0.9196	1.8246	0.6332
St. dev of NP ADF Test of NP Mean of ∆NP	6.7680 -1.6331 -0.0167	5.1954 -4.5293* 0.0162	1.2965 -6.7081* -0.0004
Mean of |∆NP|	0.6269	1.0225	1.1595
∆Price			
Mean	0.0004	0.0015	0.0015
Median	-0.0005	0.0053	0.0028
St. dev ADF Test	0.0750 -32.713*	0.0513 -33.927*	0.0811 -29.528*

Notes: Net positions (NPs) are measured in unit of 10,000 contracts. * denotes significance level at 1%.

4. Empirical Results

Figure 2 presents hedging positions in 10000 contracts. On average hedgers take net short positions and speculators take net long positions for all markets with the exception of natural gas market. Not surprisingly hedgers and speculators take opposite positions. Hedgers hold the largest net short positions in crude oil market and positions of speculators and hedgers roughly offset each other in crude oil market. Our results for natural gas futures markets are in contrast with Sanders *et al.* (2004) who find for energy markets commercials are net short and non commercials are net long, departure from their results stem from the use of the extended and more recent data set which includes the substantial increase in trading activity in commodity futures contracts whereas Sanders' data set ends in December 28, 1999. This result may also indicate that there was a structural change in natural gas trading after the mid 2000s.

Figure 3 presents hedging pressure results.[8] Hedging pressure values presents mixed patterns with some positive some negative values indicating a range of different hedging behavior across markets and time. In natural gas market there is noticeable increase in percent of long positions after 2005. The results of Working Index is presented on Figure 4. As it can be seen from Figure 4 there is a noticeable upward in the index for both crude oil and natural gas futures markets starting from the beginning of 2002.

[8] Hedging pressure= Short commercial positions - Long commercial positions / Total commercial positions.

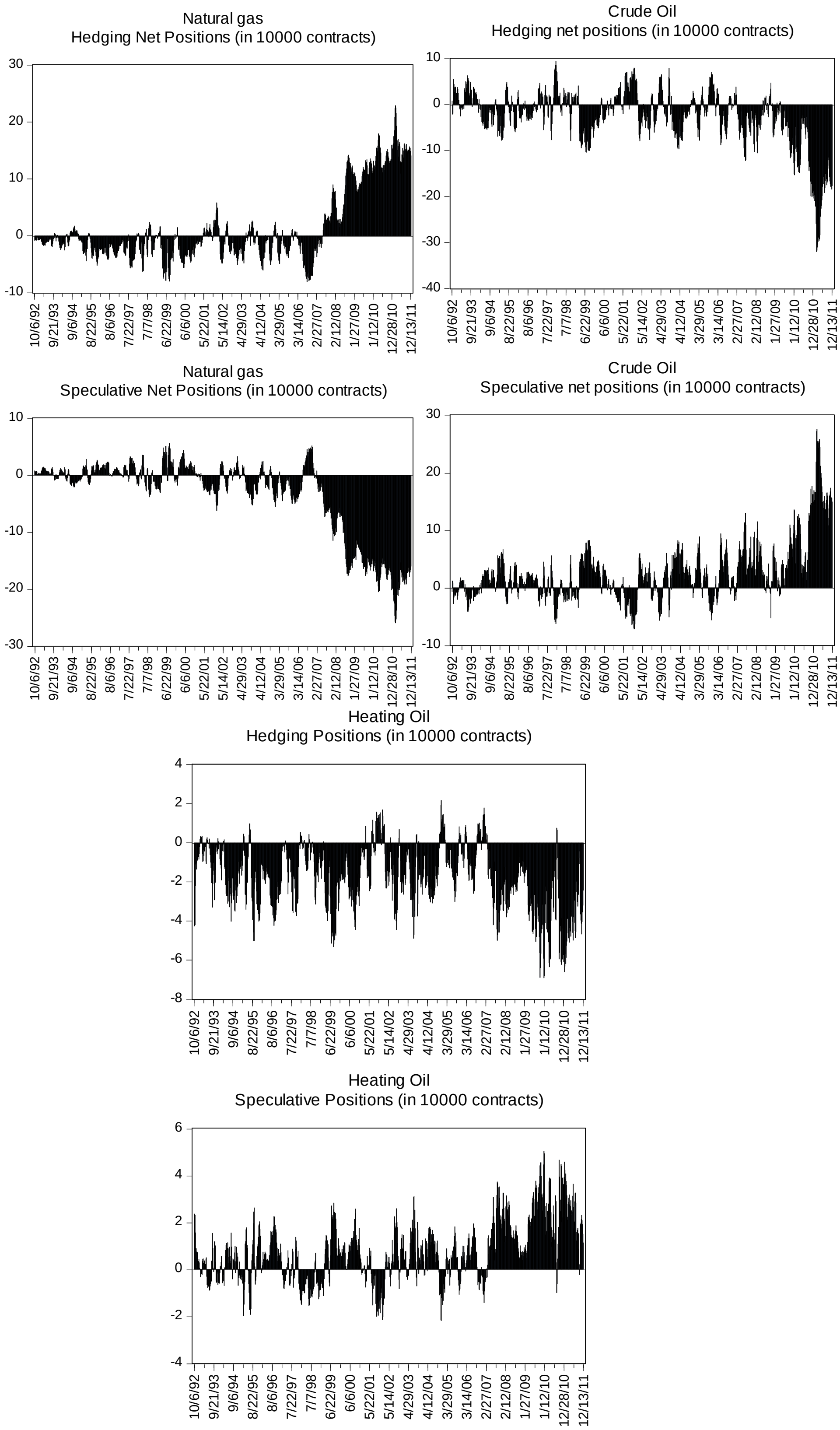

Figure 2. Net positions

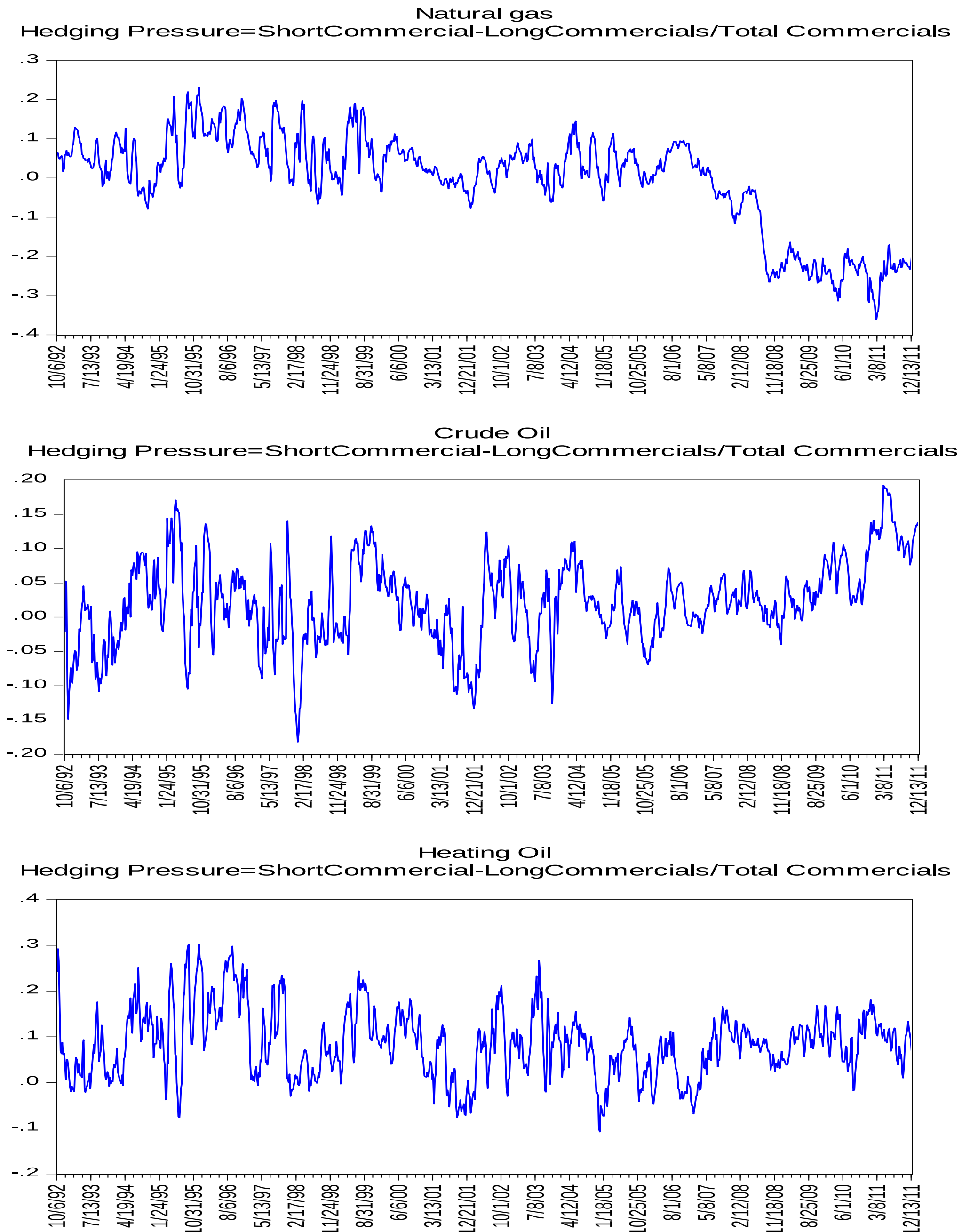

Figure 3. Hedging pressure

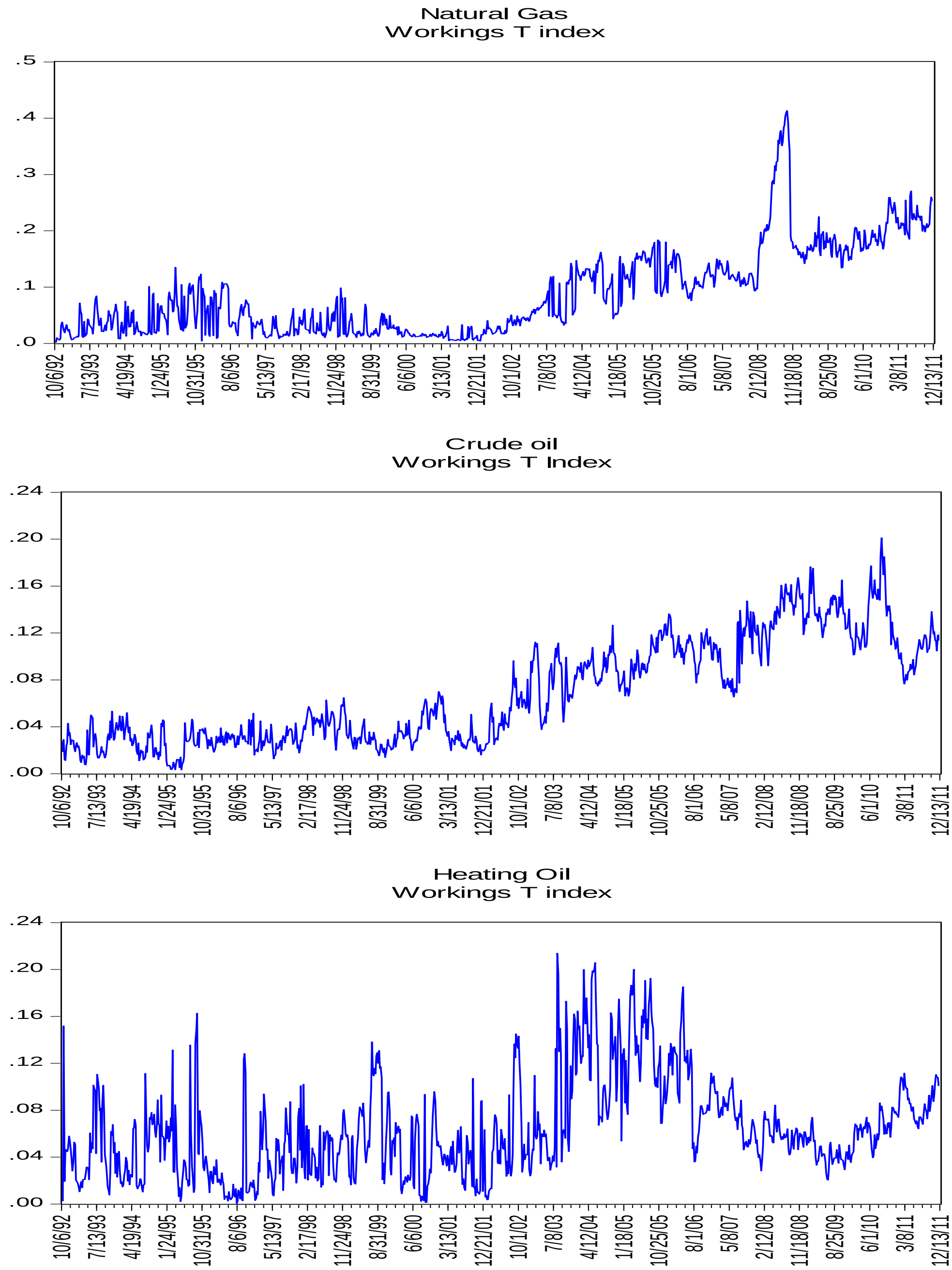

Figure 4. Working's T index

Lastly we examine the effects of net positions and changes in net positions on energy futures price changes, the results are given Tables 2 and 3 respectively.

Table 2. Net positions and energy price regressions

	Natural gas		Crude oil		Heating oil	
	Hedger	**Speculator**	**Hedger**	**Speculator**	**Hedger**	**Speculator**
α	0.0019 (0.7947)	0.0038 (1.4193)	-0.0016 (-0.9035)	-0.0020 (-1.1291)	-0.0102* (-2.6361)	-0.0039 (-1.3142)
k=0 β	-0.0013* (-3.3392)	0.0000* (2.7152)	-0.0011* (-4.2608)	0.0013* (4.2202)	-0.0061* (-4.0349)	0.0071* (3.5953)
α	0.0019 (0.8027)	0.0039 (1.4828)	0.0007 (0.4165)	0.0006 (0.3187)	0.0005 (0.1238)	0.0011 (0.3655)
k=1 β	-0.0013* (-3.4165)	0.0000* (2.8589)	-0.0002 (-1.0510)	0.0003 (0.9665)	-0.0006 (-0.3555)	0.0006 (0.2834)
α	0.0052 (1.1013)	0.0107 (2.0603)	0.0044 (1.3331)	0.0048 (1.4028)	0.0061 (1.1312)	0.0053 (1.2765)
k=4 β	-0.0032* (-4.2894)	0.0000* (3.8116)	-0.0006 (-1.1986)	0.0004 (0.7991)	-0.0000 (-0.0163)	0.00112 (0.4232)
α	0.0075 (1.1332)	0.0153 (2.0803)	0.0096* (2.0683)	0.0102* (2.1230)	0.0092 (1.3460)	0.0095** (1.8047)
k=8 β	-0.0040* (-3.7014)	0.0000* (3.5595)	-0.0009 (-1.3392)	0.0007 (0.9001)	-0.0019 (-0.7226)	0.0046 (1.3049)
α	0.0102 (1.2912)	0.0201 (2.3053)	0.0136* (2.3257)	0.0145* (2.3963)	0.0127 (1.5574)	0.0139* (2.2195)
k=12 β	-0.0046* (-3.5423)	0.0000* (3.9562)	-0.0016* (-1.8531)	0.0013 (1.2822)	-0.0036 (-1.1066)	0.0074** (1.7755)

Notes: $\Delta p_{t+k}=\alpha+\beta NP_t+\varepsilon_t$. t-statistics are given in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

The contemporaneous relationship presented in first row is significant for all markets for Net Position regression presented at Table 2. This indicates that net positions and prices move together. The estimated slope coefficients are uniformly negative for hedgers and positive for speculators throughout all contracts. However, the evidence suggest that predictive power the net positions is fairly weak for all markets except natural gas futures market.[9] For crude oil market only hedgers' net positions are predictor of changes in prices over the 12 week horizon and for heating oil market only speculators' net position are significant over the 12 week horizon. In sum, the speculators' and hedgers' net positions mostly do not have predictive power over the relevant horizons for the examined contracts. In general the estimated intercepts for future price changes are insignificant. Table 3 presents regression results pertaining to the relationship between changes in net positions and energy price movements. We examine the effect of current weekly changes of net positions on futures price changes. The changes in net positions are relatively more informative compare to the level of net positions. Specifically current changes in net position can forecast futures price changes up to 12 weeks ahead for natural gas market and up to 4 weeks in crude oil markets. For heating oil market the coefficient of changes in net positions are significant up to 1 week ahead. It is also interesting to note that changes in hedgers' net positions tend to negatively covary with futures price changes. This negative co-variation suggest that hedgers hold more long contracts on the futures market before the futures prices move downward.

[9] However, the results related to natural gas markets should be interpreted with caution since net position data are not stationary.

Table 3. Change of net positions and energy price regressions

	Natural gas		Crude oil		Heating oil	
	Hedger	**Speculator**	**Hedger**	**Speculator**	**Hedger**	**Speculator**
α k=0 β	0.0004 (0.1683) 0.0013 (0.4877)	0.0003 (0.1495) -0.0038 (-1.2314)	0.0013 (0.8581) -0.0122* (-13.142)	0.0013 (0.8604) 0.0141* (13.0434)	0.0015 (0.6331) -0.03729* (-9.8112)	0.0015 (0.6265) 0.06461* (-9.1135)
α k=1 β	0.0005 (0.2282) -0.0076* (-2.8285)	0.0005 (0.2351) 0.0079* (2.5209)	0.0015 (0.9030) -0.0025* (-2.5003)	0.0015 (0.9008) 0.0032* (2.7789)	0.0015 (0.0025) -0.00814** (-2.0484)	0.0015 (0.5925) 0.0072 (1.3715)
α k=4 β	0.0025 (0.5570) -0.0533* (-0.5687)	0.0027 (0.6016) 0.0586* (10.0036)	0.0059** (1.9761) -0.0035** (-1.9115)	0.0059** (1.9736) 0.0041** (1.8843)	0.0061* (1.7281) -0.0057 (-1.0379)	0.0061** (1.7286) 0.0383 (0.5253)
α k=8 β	0.0042 (0.6596) -0.0559* (-7.6773)	0.0044 (0.6946) 0.0635* (7.5232)	0.0122* (2.8450) -0.0019 (-0.7424)	0.0122* (2.8453) 0.0016 (0.5309)	0.0129* (2.8485) 0.0014 (0.2051)	0.0129* (2.8489) -0.0043 (-0.4611)
α k=12 β	0.0066 (0.8639) -0.0585* (-6.6979)	0.0069 (0.9061) 0.0662* (6.5314)	0.0181* (3.3424) 0.0000 (0.0213)	0.0180* (3.3391) 0.0009 (0.2475)	0.0196* (3.6020) -0.0036 (-0.4224)	0.0196* (3.6020) 0.0028 (0.2493)

Notes: $\Delta p_{t+k}=\alpha+\beta\Delta NP_t+\varepsilon_t$. t-statistics are given in parenthesis. *, ** and *** represent 1%, 5% and 10% significance level respectively.

6. Conclusion

We present an empirical analysis in this paper by investigating the relationship between futures trading activity and changes in energy futures prices in selected energy markets. In conclusion this paper provides evidence that the level of net positions mainly is not helpful explaining price changes in examined markets with the exception of contemporaneous estimations. Our results suggest that change in the net positions rather than the level of net positions has an impact on futures price movements. Thus the policy argument aimed at limiting speculative positions in energy markets are not supported by empirical evidence.

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