Does Investor's Sentiment Predict Prices Movements?

A Case Study of the NYMEX Petroleum Futures Markets

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Abstract

This paper studies whether actual position-based investor sentiment is useful in predicting price movements in three major petroleum futures markets: crude oil, heating oil, and unleaded gasoline. Using Wang (2003)'s methodology for the sentiment measurement and weekly actual position data during 1996 ~ 2006 from the COT report, the investors' sentiments are found to have an insignificant influence on futures price movements in subsequent periods. Our results suggest that either the actual position-based sentiment index is faulty or investor's sentiment is not related to subsequent price movements in the petroleum futures markets.

JEL Classification: G12; G13
Keywords: NYMEX; Investor sentiment; Petroleum futures;

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1. Introduction

Over the recent years, the petroleum futures markets have been drawing great attention for its sizable growth and emergence as a new factor to bring high oil prices. In case of New York Mercantile Exchange (NYMEX)[1] crude oil futures, for example, daily net positions in nearby contracts that expire within three months have grown by 145 percent from early 2000 through mid-2006, and even those in long-term contracts that expire in three years or longer have increased around 262 percent over the same time period. Moreover, as investors' sentiment has been debatably argued to contribute the turbulence of the petroleum futures prices, observers of futures markets focus on the question if petroleum futures price movements can be anticipated by investor's sentiment.[2]

Due to the difficulty of directly measuring unobserved sentiment of investors, however, most previous studies limitedly focused on opinion-based sentiment measurement in the context of stock market.[3] Up to date, only few papers such as Wang (2001, 2003) shed light on actual position-based sentiment in commodity futures market[4].

Wang's methodology is useful in utilizing the actual data on investor's trading-position, which enable us to measure the unobserved sentiment of investors in commodity markets over financial markets. By taking Wang (2001, 2003)'s methodology, this paper examines whether the actual position-based sentiment of two investors, hedgers and speculators, is related to price movements in the subsequent periods of the NYMEX petroleum futures markets: crude oil, unleaded gasoline, and heating oil.

Our principal finding is that the actual position-based investors' sentiments and does not significantly predict price movements in the petroleum futures markets unlike the recent studies on agricultural and equity markets by Wang (2001, 2003). Even in the bullish investing period or skyrocketing oil price period, the sentiment did not provide statistically significant information for the price movement. These findings suggest that either actual position-based sentiment index is an inappropriate measure to capture "true" sentiment of investors in the market or the sentiment is not inherently related to future prices at least in the petroleum futures markets. Consequently, these findings imply that hedging-pressure theory cannot be supported by the methodology of the actual position-based sentiment index since sentiments do not play a role in signaling returns movements.

The remainder of this paper is organized as follows. Section 2 briefly reviews the existing relevant literature. Section 3 describes data and methodology. Then we provide the empirical result in Section 4, and the concluding remarks are suggested in Section 5.

2. Literature Review

[1]The NYMEX is the largest commodity exchange in the world. The major trading commodities for futures and options are natural gas, petroleum products, electric power, coal and precious metals.

[2] Tim Evans argued that the oil market is not bullish in physically but in financially in *New York Times* at April 27, 2005. As the recent mass-media argument, Steve Hargreaves stressed at *CNNMoney* at January 9, 2007 as the following: "Speculators keep oil prices afloat….Many analysts agree this due in large part to the amount of speculative investment money pouring into the market…"

[3] For more details, please see the section of Literature Review.

[4] By selecting agricultural futures markets and using Commitments of Traders (COT) reports provided by Commodity Futures Trading Commission (CFTC), Wang (2001) concludes that futures price movements can be anticipated by the actual position-based investor's sentiment index.

Although the efficient market hypothesis (EMH) has been widely accepted in the field of finance (Lo and Lin, 2005), there exists a body of literature arguing that investors may be irrational and their trade activities affect prices of securities (Shefrin and Statman, 1985; De Long et al, 1990). They suggest that there might be some non-fundamental factors which can affect asset price formation significantly and may even predict the price movements in the relevant markets.

Investor's sentiment, one of prime suspects for non-fundamental factors affecting prices, has been studied by numbers of financial researchers. Most of early studies, however, have investigated investor's sentiment in equity markets but provided no significant evidence. For example, Solt and Statman (1988) find that the sentiment of investment newsletter writers does not forecast futures prices, and Siegel (1992) and Clarke and Statman (1998) conclude that the sentiment indicator from *Investors Intelligence*, does not predict futures prices movements. More comprehensively, Fisher and Statman (2000) finds that the sentiments of both small investors and Wall Street strategists are reliable contrary indicators for future S&P 500 stock returns, but not the sentiment of newsletter writers.

Statistically significant relationship between investor's sentiment and subsequent price movements has been detected in recent studies as they utilize the actual position-based sentiment of investors. *Investors' Intelligence* sentiment index, contrary to previous studies, has been proved a significant factor for explaining excess returns and the greater bullish (bearish) sentiment leads the higher (lower) further excess returns (Lee et al, 2002), and the data from the Individual Investors' Sentiment Index of *Apple Daily* might be useful in explaining temporary stock price changes (Chan and Fong, 2004). More recently, the sentiment indices constructed from Commitments of Traders (COT) data have been identified as a strong indicator of returns in agricultural futures markets (Wang 2001, 2003) as well as in foreign currency futures markets (Wang 2002). Verma and Soydemir (2006) also find that individual investor sentiment from the American Association of Individual Investors (AAII) and the institutional investor sentiment from Investors Intelligence (II) affects not only the U.S. stock market but also some foreign stock markets.

In addition, investor's sentiment affecting prices movement is related to the hedging-pressure theory (Keynes, 1930; Hicks 1939). According to the hedging-pressure theory, futures premiums are directly linked to hedgers' net positions (e.g., Hirshleifer,1988, 1990; Stoll, 1979) since the hedging pressure results from risks that hedgers cannot, or do not want to bear in transaction, such as high transaction costs and severe information asymmetries. The hedging-pressure theory has been empirically supported in broad futures markets (e.g., Houthakker, 1957; Bessimbinder, 1992; De Roon et al, 2000 etc.). In specific, Chang (1985) investigates price movements in three agricultural futures markets and reports that prices rise (fall) more often than expected on a random basis in months when large speculators (hedgers) have net long positions. Hartzmark (1987), however, concludes that hedgers are benefiters when speculators are not, and vice versa.

3. Methodology and Data

The data on open interest net long position of each type of investors in the petroleum futures markets are basically from Commodity Futures Trading Commission

(CFTC)[5]. More specifically, we collect the weekly COT data on Tuesdays' closing positions aggregated for all outstanding contracts by commercial traders (hedgers) and noncommercial traders (speculators) participating in the crude oil, heating oil, and unleaded gasoline futures markets over the period from January 1996 to November 2006.

Figure 1 particularly demonstrates the symmetric time trends of interaction between hedgers' and speculators' net positions. The volatility of the net position changes before 2003 are about half as much as those after 2003 in the unleaded gasoline market. Since the larger volatility could be due to growing size of the market, simple net position changes of investors might over- or under-estimate the true sentiment depending on investigation period.

[Insert Figure 1 here]

By constructing the sentiment index can be handled the difficulty in the net long position. The sentiment index is more useful than the raw net position data in respect of its wide acceptability by market practitioners, feasibility of the comparative analysis across futures market and intuitive readability of the investor's action (Wang, 2001). Employing the methodology of Wang (2001, 2003), an actual position-based sentiment index for each investor in the market *j* is defined as the following, which is similar to the COT index in the marketplace.

$$SI_{it}^{j} = \frac{S_{it}^{j} - \min\left(S_{it}^{j}\right)}{\max\left(S_{it}^{j}\right) - \min\left(S_{it}^{j}\right)} \qquad (1)$$

where S_{it}^{j} is the aggregate position for trader type *i* at week *t* detrended using total open interest, *i* represents non-commercial traders (regarded as speculators) and commercials (regarded as hedgers), respectively. Aggregate position is defined as long open interest less short open interest, and $\max\left(S_{it}^{j}\right)$ and $\min\left(S_{it}^{j}\right)$ represent historical maximum and minimum aggregate positions over the previous three years[6].

[Insert Table 1 here]

[5] CFTC requires certain exchange members and futures commission merchants (i.e., brokers) to file daily reports with the Commission. Those reports show the futures positions of traders that hold positions above reporting levels set by CFTC regulations (referred to as "reportable positions"). Each trader is classified as being either commercial or noncommercial, with commercial traders being those engaged in spot-market-activities whereas noncommercials are not. The data collected as of each market's close on each Tuesday are released to the public in the CFTC's Commitments of Traders (COT) report, generally on the following Friday

[6] Since there is no consensus in choosing the base period yet in practice, we select three years as Wang (2001, 2003) employed. Also, we conducted different base periods, such as one year, two years, four years, and five years, but the qualitative results provide little changes.

Table 1 provides summary statistics of sentiment by type of traders (Panel A) and correlation matrix of sentiments between traders (Panel B) corresponding to COT data. The greater standard deviation of the sentiment in the crude oil futures than the other two markets demonstrates that investor's position-transacting (changes between holding short- and long-position) is more active in crude oil futures markets. Panel B clearly shows that the sentiments of speculators and hedgers are negatively correlated. The correlation coefficients between these two investor's sentiments are more than 0.9 in all three markets. Figure 2 shows the symmetric interaction between two investors in the selected petroleum futures market. Unlike the net long position in Figure 1, the sentiment index does not show the volatility-changing pattern of unleaded gasoline market.

[Insert Figure 2 here]

Following Solt and Statman (1988) and Fisher and Statman (2000), the subsequent price movement is estimated with the actual position-based sentiment index of each investor.

$$R^{j}_{t+K} = \alpha^{j}_{i} + \beta^{j}_{i} SI^{j}_{it} + \varepsilon^{j}_{it} \qquad (2)$$

where R^{j}_{t+K} represents returns in market j in K weeks, $K = 1, 2, 4, 6$, and i represents large speculators and large hedgers, respectively. A positive slope coefficient of eq. (2) suggests that the sentiment of a trader group is a straight buying or selling indicator, while a negative slope coefficient implies a contrary indicator.

Returns are calculated by Tuesday's settlement prices from Energy Information Administration (EIA) corresponding to investor's sentiment data. Table 2 provides summary statistics for weekly returns in three petroleum futures markets over the sample period. The average weekly returns and standard deviations are very similar across all three petroleum futures markets. This similarity in average return may reflect the characteristics of joint-products markets.

[Insert Table 2 here]

4. Empirical Results

Table 3 reports the regression results from estimating eq. (2) for two types of investors in the three major petroleum futures markets from the first week of January 1996 to the fourth week of November 2006. Panel A shows estimates of the slope coefficient for the speculator's sentiment and Panel B for hedger's sentiment.

As shown, both of speculator's and hedger's sentiments are statistically insignificant for all upcoming futures returns such as 1-week, 2-week, 4-week and 6-week. The results demonstrate that the actual position-based sentiment index from the COT data does not provide any information for forecasting the futures prices movements

in major petroleum futures markets unlike agricultural futures market (Wang 2001, 2003) or foreign currency futures market (Wang 2002). Contrary to the widespread argument on the cause of recent high oil price, estimation results imply that speculators hardly lead the petroleum prices at least in futures markets.

[Insert Table 3 here]

For more precise checking the effect of the sentiment index on futures returns, we also examine sentiment-based timing strategies. First, for the sentiment-specific investigation, the bullish investor is defined as those who have higher sentiment level than the mean over the entire sample period. For example, the bullish speculator (BS) of crude oil market was retrieved when the speculator's sentiment index is higher than 0.52 and the bullish hedger (BH) when the hedger's index is over 0.49. Bullish-level sentiment may have predictability for price movements because more active investors are more likely to signal market movements. Second, since the oil price after 2003 has been moving away from the previous 20-year equilibrium, we examine the return predictability of investor's sentiment after the year of 2004.

[Insert Table 4 and Table 5 here]

Additional test examines the possibility that the petroleum futures price movements are more likely to be affected by investor's sentiments when the market uncertainties are greater. However, Table 3 shows that the bullish investors are not statistically significant on the subsequent-periods returns. Table 4 also exhibits that investor's sentiment is good-for-nothing in predicting the future prices movements of petroleum markets even in the high oil price period.

Empirical results eventually demonstrate that either investor's sentiment index is not implemental for predicting returns or investor's sentiment is not inherently related to predicting returns for the petroleum futures markets. Especially, Table 4 may imply that returns to non-fundamental risks in the petroleum futures markets are not significant to speculators or hedgers. The results can be a counter-evidence to the hedging-pressure theory since both investors' sentiments do not play a role in signaling returns movements.

5. Conclusion

This paper constructed the actual position-based sentiment by type of traders and tested whether the investor's sentiment is related to returns for the subsequent periods in three major petroleum futures markets, namely crude oil, heating oil and unleaded gasoline.

Empirical results with the COT data show that both speculators and hedgers sentiment indexes are not significantly related to the returns for the subsequent periods: 1 week, 2 weeks, 4 weeks, and 6 weeks. Unlike Wang (2001 and 2003) on the agricultural and several equity markets, return predictability of investor's sentiment has been estimated statistically insignificant in the petroleum futures markets even with sentiment- and period-specific considerations.

Implications in this study are as follows. First, investor sentiment based on trader actual positions is not useful for predicting petroleum futures returns, unlike recent studies on agricultural and equity futures markets. Second, our result provides no empirical evidence to the argument that bullish speculators are likely to lead the price in the petroleum futures market. Third, hedging-pressure effects do not tend to prevail in the petroleum futures markets as long as the actual position-based sentiment index is used.

References

Arnold, C. (1995). PPS trading system. Toronto, Canada: Irwin Publishing.

Bessembinder, H. (1992). Systematic risk, hedging pressure, and risk premiums in futures markets. *Review of Financial Studies*, 47, p2015-p2034

Bryant, H. L., Besssler, D. A. & Haigh, M. S. (2006). Causality in Futures Markets. *Journal of Futures Markets*, 26, p1039-1057

Briese, E. (1994, May 2). Illuminating data: Commitments of traders report can disclose promise, perils in the market. Barron's, 20.

Chang, E. C. (1985). Returns to speculators and the theory of normal backwardation. *Journal of Finance*, 40, p193-p208

Chang, E. C., Pingenar, J. M., & Schachter, B. (1997). Interday variations in volume, variance and participation of large speculators. *Journal of Banking and Finance*, 21, p797-p810

Clarke, R. G., & Statman, M. (1998). Bullish or bearish. *Financial Analysts Journal*, 54, p63-p72

De Bondt, W. (1993). Betting on trends: Intuitive forecasts of financial risk and returns. *International Journal of Forecasting*, 9, p355-p371

De Roon, F., Nijman, T., & Veld, C. (2000). Hedging pressure effects in futures markets. *Journal of Finance*, 55, p1437-p1456.

Fisher, K. L., & Statman, M. (2000). Investor sentiment and stock returns. *Financial Analysts Journal*, 56, p16-p23.

Hicks, J. R. (1939). Value and capital. Cambridge, UK: Oxford University Press.

Hirshleifer, D. (1988). Residual risk, trading costs, and commodity futures risk premia. *Journal of Political Economy*, 1, p173-p193.

Hirshleifer, D. (1990). Hedging pressure and futures price movements in a general equilibrium model. *Econometrica*, 58, p411-p428.

Houthakker, H. S. (1957). Can speculators forecast prices? *Review of Economics and Statistics,* 39, p143-p151.

Keynes, J. M. (1930). A treatise on money, Vol. 2. London, UK: Macmillian.

Newey, W. K., & West, K. D. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55, p703-p708.

Rockwell, C. (1967). Normal backwardation, forecasting, and the returns to commodity futures traders. Food Research Institute Studies, 7, 1967, 107.130.

Sanders, D. R., Irwin, S. H., & Leuthold, R. M. (1997). Noise traders, market sentiment, and futures price behavior. Working Paper. University of Illinois at Urbana-Champaign.

Solt, M. E., & Statman, M. (1988). How useful is the sentiment index? *Financial Analysts Journal,* 44, p45-p55.

Stoll, H. R. (1979). Commodity futures and spot price determination and hedging in capital market equilibrium. *Journal of Financial and Quantitative Analysis*, 14, p873-p894.

Wang, C. (2001), Investor sentiment and return predictability in agricultural futures markets, *Journal of Futures Markets*, 21, p929-p952

Wang, C. (2003), Investor sentiment, market timing, and futures returns, *Applied Financial Economics*, 13, p891-p898

White, H. (1980). A heteroskedasticity consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48, p817-p838.

Table 1. Summary Statistics of Investor Sentiment (1996.1~2006.11)

Panel A: Investor Sentiment by Type of Traders

	Speculator		Hedger	
	Mean	Std. Dev.	Mean	Std. Dev.
Crude oil	0.52	0.30	0.49	0.29
Heating oil	0.49	0.21	0.55	0.22
Unleaded Gas	0.49	0.26	0.47	0.26

Panel B: Correlation between hedger's and speculator's sentiment in each market

	Crude Oil	Heating Oil	Unleaded Gasoline
Correlation	-0.94	-0.93	-0.90

Table 2. Summary Statistics of Weekly Futures Return (%) (1996.1~2006.11)

	Crude Oil	Heating Oil	Unleaded Gasoline
Mean	0.003	0.003	0.003
Maximum	0.21	0.17	0.33
Minimum	-0.21	-0.18	-0.21
Std. Dev.	0.05	0.05	0.06
No of obs.	567	567	567

Table 3. The Relation Between the Level of sentiment by Type of Traders and Futures Returns (%) in Subsequent (Nonoverlapping) Periods (1996.1~2006.11)

	1Week	2Week	4 Week	6 Week
Panel A: Speculators				
Crude oil	-0.005	0.003	-0.002	-0.000
	(0.61)	(0.41)	(0.31)	(0.00)
Heating oil	-0.008	-0.001	0.001	-0.003
	(0.76)	(0.08)	(0.08)	(0.32)
Unlead. Gas	-0.002	0.002	-0.007	-0.003
	(0.25)	(0.22)	(0.70)	(0.34)
Panel B: Hedgers				
Crude oil	0.006	-0.004	0.003	0.000
	(0.73)	(0.50)	(0.42)	(0.01)
Heating oil	0.008	0.005	0.001	-0.000
	(0.79)	(0.46)	(0.11)	(0.04)
Unlead. Gas	0.006	0.003	0.013	0.008
	(0.67)	(0.33)	(1.31)	(0.84)

The regression results are from the estimation of eq. in 2.(p 4) with weekly observations. Only slope coefficients are reported. The numbers in parentheses are t-statistics under the null hypothesis that the relevant parameters is zero, computed using White (1980) heteroskedasticity consistent standard errors. ** is statically significant at 99% and * is statically significant at 95% level

Table 4. The Relation Between the Level of sentiment by Type of Traders and Futures Returns (%) in Subsequent (Nonoverlapping) Periods (1996.1~2006.12)

	1Week	2Week	4 Week	6 Week
Panel A: Bullish Speculators (BS)				
Crude oil	0.001	0.002	-0.006	0.007
	(0.03)	(0.14)	(0.36)	(0.40)
Heating oil	-0.011	0.030	-0.015	0.006
	(0.48)	(1.26)	(0.65)	(0.21)
Unlead. Gas	0.021	0.026	0.000	0.005
	(1.19)	(1.45)	(0.02)	(0.26)
Panel B: Bullish Hedgers (BH)				
Crude oil	0.011	0.003	-0.010	-0.004
	(0.55)	(0.13)	(0.54)	(0.19)
Heating oil	0.001	-0.010	0.009	0.022
	(0.03)	(0.37)	(0.33)	(0.81)
Unlead. Gas	-0.003	-0.002	0.003	-0.000
	(0.14)	(0.10)	(0.11)	(0.02)

The regression results are from the estimation of eq. in 2.(p 4) with weekly observations. Only slope coefficients are reported. The numbers in parentheses are t-statistics under the null hypothesis that the relevant parameters is zero, computed using White (1980) heteroskedasticity consistent standard errors. ** is statically significant at 99% and * is statically significant at 95% level

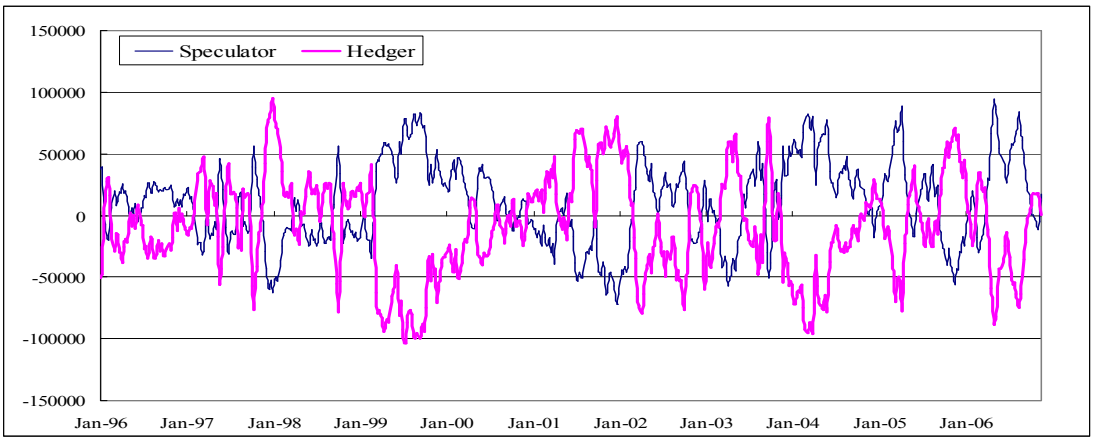
Table 5. The Relation Between the Level of sentiment by Type of Traders and Futures Returns (%) in Subsequent (Nonoverlapping) Periods (2004.1~2006.11)

	1Week	2Week	4 Week	6 Week
Panel A: Speculators				
Crude oil	-0.008	-0.006	-0.016	-0.011
	(0.65)	(0.49)	(1.32)	(0.91)
Heating oil	-0.027	0.009	-0.023	-0.019
	(1.05)	(0.35)	(0.89)	(0.74)
Unlead. Gas	0.004	0.015	-0.003	0.010
	(0.18)	(0.70)	(0.14)	(0.44)
Panel B: Hedgers				
Crude oil	0.009	0.006	0.016	0.012
	(0.71)	(0.49)	(1.26)	(0.96)
Heating oil	0.022	-0.011	0.019	0.016
	(0.89)	(0.46)	(0.78)	(0.62)
Unlead. Gas	0.002	-0.007	0.009	-0.003
	(0.09)	(0.33)	(0.38)	(0.12)

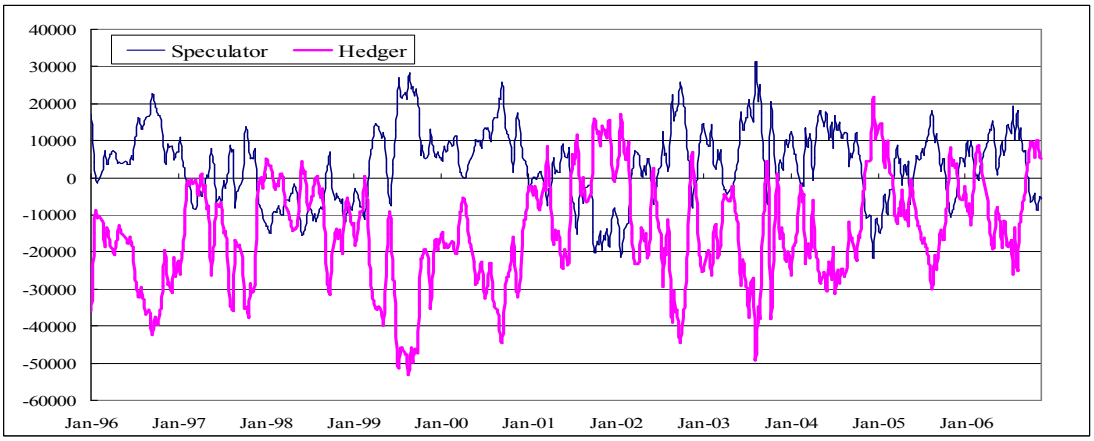
The regression results are from the estimation of eq. in 2.(p 4) with weekly observations. Only slope coefficients are reported. The numbers in parentheses are t-statistics under the null hypothesis that the relevant parameters is zero, computed using White (1980) heteroskedasticity consistent standard errors. ** is statically significant at 99% and * is statically significant at 95% level

Figure 1. Speculator's and Hedger's Net Long-Position (1996.1~2006.11)

Panel A: Crude Oil



Panel B: Heating Oil



Panel C: Unleaded Gasoline

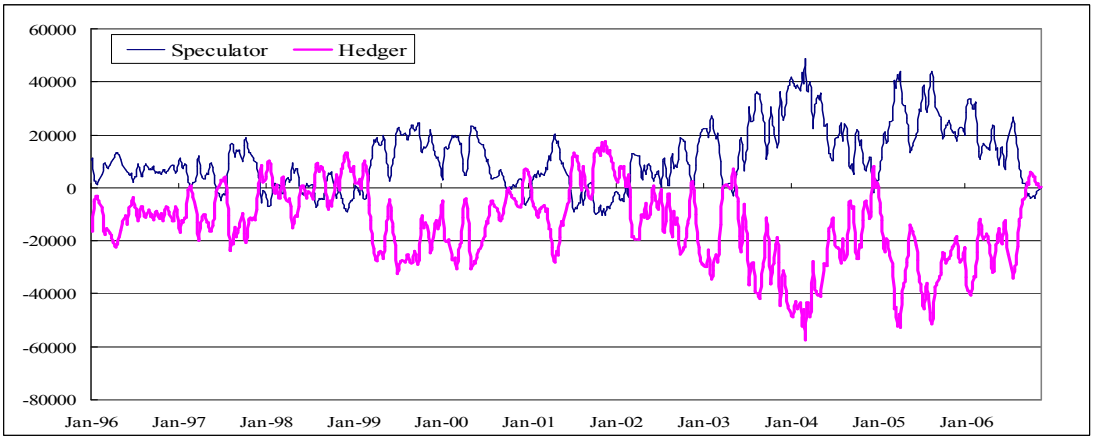
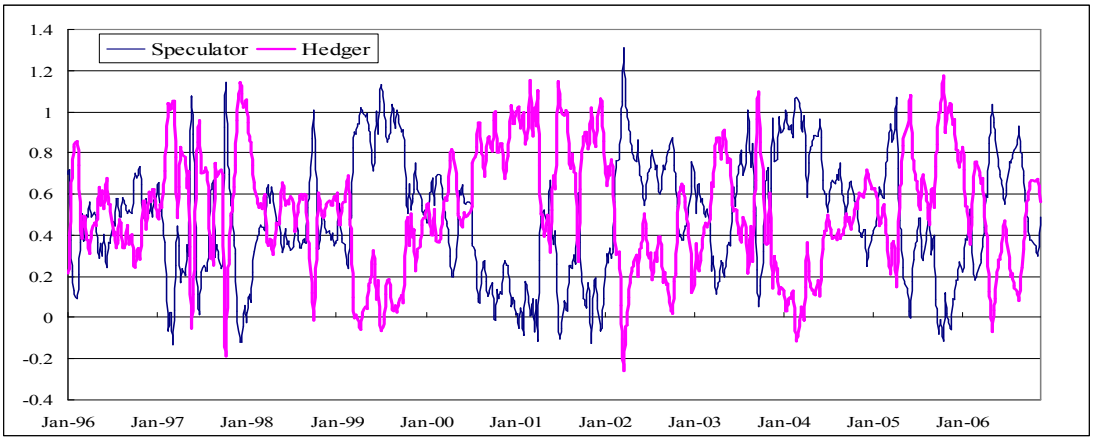
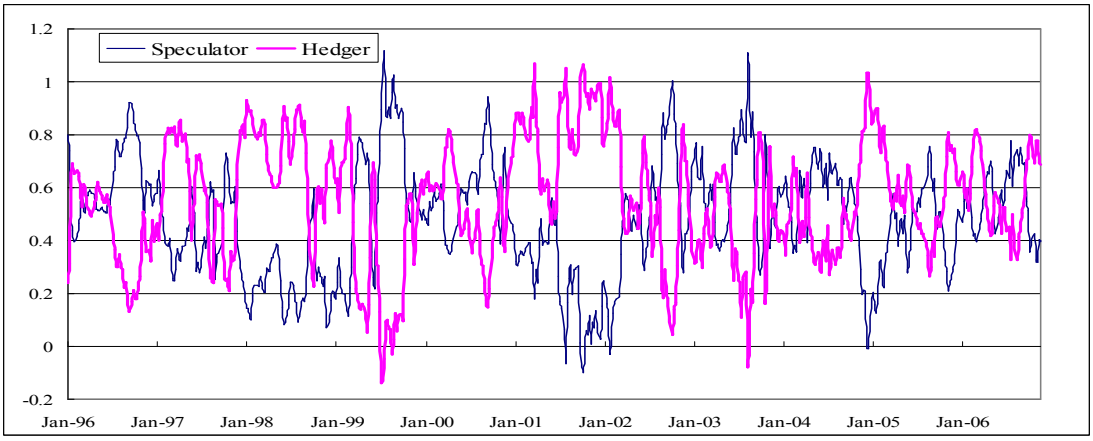


Figure 2. Speculator's and Hedger's Sentiment Interaction (1996.1~2006.11)

Panel A: Crude Oil



Panel B: Heating Oil



Panel C: Unleaded Gasoline