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Returns to Speculators in Commodity Futures Markets: A Comprehensive Revisit**

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Abstract

This study investigates the performance of large speculators in 22 commodity markets over the last 15 years. We find that large speculators were profitable in many markets. Two possible sources of returns are analyzed for their relevance in these gains: The ability to forecast and the flow of risk premia. In contrast to earlier studies we use direct test procedures for both assessments. We find very little evidence of market timing ability. However, employing the theory of storage and using a volatility measure to proxy for convenience yield, we observe consistent risk premium earnings. Furthermore, momentum may be seen as a third source of returns to speculative activity.

Keywords: Commodities, Returns to Speculators, Forecasting Ability, Risk Premium, Theory of Storage, Term Structure of Futures Prices

JEL classification: G13, G14

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I. Introduction

Measuring the returns of speculative traders and identifying their sources is important for understanding the processes inherent in futures markets. It is a concern for academics, policy makers and market participants alike. In recent years it has gained additional topicality in many commodity markets. In such markets the size of speculative positions has grown at much higher speed than those of commercial participants, which are linked to business in the underlying spot market. Respective figures can be found in the weekly Commitment of Traders Report issued by the U.S. Commodity Futures Trading Commission, a useful data source for studying futures positions. In these reports, the open interest of major futures markets is split into commercial (‘hedgers’) and non-commercial open interest (‘speculators’) of large traders, as well as open interest of ‘small’ traders. Figure 1 depicts the development of these groups for nine major markets, as well as the proportion of speculative positions to total open interest.

[Insert Figure 1 about here]

In the futures market context, returns to speculators are generally attributed to two potential sources: Superior forecasting ability and the flow of risk premia. Superior forecasting ability hints to inefficiencies and allows the forecaster to ‘generate alpha’, i.e., acquire returns which are not related to market returns. The occurrence of risk premium flows, on the other hand, does not contradict with the efficiency hypothesis. It can be caused, for instance, by hedging pressure: Hedgers want to participate in a market to get rid of their non-diversifiable risk. In order to motivate speculators to take over their unwanted risk, they have to provide an insurance premium. This is known as the ‘normal backwardation hypothesis’.

The question of speculator profitability has been addressed by a number of studies, but results have been very ambiguous. The disparity in the findings may be due to two reasons. First, returns and their sources may vary across the different markets under investigation. Second, many earlier studies employ rather strong assumptions in order to be able to make inference on risk premia and forecasting ability, for example the inability of small traders to forecast prices.

The goal of this study is to reassess the profitability of speculative activity in commodity markets and to analyze their drivers. This study contributes to the ongoing discussion in two ways. First, previous research is updated with data on a broad cross-section of 22 individual commodity markets, covering a time span of 15 years. Results obtained over a longer time period and a greater number of markets will yield a more complete overview and more reliable results. Second, in testing explicitly and directly for both forecasting ability and the flow of a risk premium, this study avoids making inferences based on assumptions which may not be straight forward. Results indicate that speculators consistently earn risk premia but do not, in general, possess short-term forecasting ability. Nevertheless, on a larger time scale, they may also earn on "forecasting" by simply using momentum inherently present in markets. This may additionally explain some of the ambiguities on forecasting performance in earlier results.

The remainder is organized as follows. The next section presents a review on literature in this field. Section III describes the data set. Section IV introduces the methodology. Section V presents results and Section VI contains the conclusion.

II. Literature Review

The larger part of the related literature assesses only forecasting power or profitability of the different trader groups directly. Risk premium flows are then assessed indirectly. For example, Chang (1985), finds positive profits for large speculators on a monthly and semi-monthly basis in wheat, corn, and soybean futures. As hedgers were additionally consistent 'losers', he concludes that a risk premium is systematically exchanged between those two groups and thus lends support for the normal backwardation hypothesis. Hartzmark (1987), on the other hand, calculates profits based on daily end-of-day positions of commercial and non-commercial market participants, covering nine futures markets over the period July 1977 to December 1981. He finds that large commercial traders were the only profitable group among most markets under investigation. In his later article, Hartzmark (1991) performs tests on forecasting power using the same data set. His finding is that returns to futures traders are randomly generated and hence he rejects the normal backwardation theory. Phillips / Weiner (1994) use transaction specific data on the international petroleum forward market for the time period covering 1983 until 1989. Their results, like those of Hartzmark, indicate that no traders make significant profits on inter-day measures and that traders in general do not possess forecasting ability. During the day, however, traders who are likely to have superior information make significant profits. Consequently, they too fail to support the normal backwardation theory. Leuthold / Garcia / Lu (1994) analyze forecasting ability with daily commitments of large traders in the frozen pork belly market between 1982 and 1990. In contrast to the two aforementioned studies, their report signals significant profits of all large reporting traders, implying losses for non-reporting small traders. Above all, they find that speculators have the ability to make consistent forecasts. Buchanan / Hodges / Theis (2001) analyse weekly prices for the natural gas market from 1993 until 1997 and perform a forecasting test. They conclude that positions of large speculators contain valuable information for predicting the direction and magnitude of subsequent price changes.

A different approach is taken by Wang (2001). He documents, with a sample of six agricultural markets (corn, soybeans, soy meal, wheat, cotton, and sugar) ranging from 1993 to 2000, that speculators outperform hedgers but does not find evidence of superior forecasting ability of speculators. Nevertheless he suggests constructing sentiment indices and assesses their forecasting value. He finds that large speculator sentiment forecasts future market movements, whereas large hedger sentiment is a contrary indicator and small trader sentiment does not have any forecasting value.

Chatrath / Liang / Song (1997) differs from the aforementioned studies in the sense that it is the only paper which directly tests for consistent risk premium gains in this context. In their examination of wheat, soybeans, corn, coffee, and cotton from 1983 to 1995 they find that large reporting speculators significantly profit in all five markets. However, they also find that speculators do not impose any instantaneous risk premium on hedgers. They conclude that the presence of speculators enhances market efficiency and lowers the cost to hedgers. This is attributed to the fact that when expected returns are high enough, speculators may be ready to enter markets at high costs.

Unlike earlier works this paper explicitly tests for both forecasting ability and risk premium flows. In relation to the former a methodology is used similar to studies like Hartzmark (1991). The analysis of Chatrath / Liang / Song (1997) is refined in relation to the latter. Furthermore, this paper extends the scope of investigated markets. It can be therefore seen as both a synthesis and extension of earlier works.

III. Data

Speculative positions are taken from the weekly Commitments of Traders Reports (CoT) issued by the U. S. Commodity Futures and Trading Commission (CFTC). Each trader who holds positions exceeding a predefined level has to report to the CFTC and classify himself either as a commercial or non-commercial trader. A commercial trader is one who is "commercially engaged in business activities hedged by use of the futures or option markets [.] This would include production, merchandising, or processing of a cash commodity, asset/liability risk management by depository institution, security portfolio risk management, etc." (CFTC Form 40). All other large traders who do not meet these criteria are classified as non-commercials. Commercials are referred to as hedgers, while non-commercials have no underlying cash business and are hence treated as purely speculative traders. Since October 1992, CoT reports are released each Friday, containing a snapshot of the past Tuesday. Total open interest is broken down into the number of contracts held by commercials, non-commercials and the number of contracts bound in non-commercial spread positions. The open interest held by traders who do not reach the reporting level is consequently calculated as the difference between total open interest and all reporting positions[1]. A comprehensive overview on the CoT data can be found in Sanders / Boris / Manfredo (2004).

As CoT reports have been available on a weekly basis since October 1992 we use data covering the period 10/1/1992 to 3/6/2007. We use prices of a broad set of 22 different commodities. A summary is presented in Table 1.

[Insert Table 1 about here]

Daily settlement prices for all traded futures are obtained from data products offered by the Commodity Research Bureau. From this data we construct continuous price time series of the contemporaneous nearby future contract (the future with the shortest time to maturity) and of further deferred contracts (each deferred series has also a constant distance to maturity which is just longer than in the nearby series) using a rolling strategy. For example, the nearby futures series contains settlement prices of the future with the shortest time to maturity. On the first day of the month of its expiry, the series switches to the futures contract with the

[1] To be more exact, open interest reflects the number of "opened" contracts in the market. Since each contract needs someone on the short as well as on the long side, open interest is equal to all long positions as well as to all short positions.

second nearest maturity, and so on. This procedure circumvents problems with thin trading, which is likely to occur very shortly before maturity. This is because many market participants are not interested in actual delivery of the underlying commodity. Furthermore, to avoid any distortions, we make sure that every absolute or percentage change which is calculated across rolling days, is computed from prices of the same future contract. Contract specifications of a future are taken from the website of its respective exchange.

IV. Methodology

PROFITS AND LOSSES OF SPECULATIVE ACTIVITY

Earlier studies measure aggregated returns to speculators on the basis of monthly futures price changes [e.g. Chatrath / Liang / Song (1997), Wang (2003)], as well as daily futures prices [e.g. Hartzmark (1987, 1991), Phillips / Weiner (1994)]. Since we have weekly commitments of traders we are able to approximate weekly profits. Because the calculation of rates of returns on futures investments - which require no initial capital investment - is arguable, we calculate the net change in speculator wealth during each week as follows: For each market we assume that traders open the net positions they report on a Tuesday evening at equal rates each day over the prior week, as well as equally distributed over the four futures with the shortest time to maturity. All four futures series are included because we observe that most of the open interest is clustered in the shorter running futures series. Furthermore, we assume that they close out their Tuesday evening positions during the following week, again equally distributed over all trading days until the subsequent Tuesday. This procedure is repeated for each week in the sample. Contract size and denotation units are accounted for. Finally, cumulating these figures over time yields the profit proxies. This procedure does not arrive at actual net profits. We use it as a approximation, because CoT data exhibit momentum.

FORECASTING ABILITY

In the following chapters we investigate two sources of speculative returns for their relevance to earnings. To assess the timing skills of speculators, procedures are readily available from the literature. The test used most frequently is the non-parametric test of Henriksson / Merton (1981) originally developed for the assessment of binary investment advice. Under the assumption that the magnitude of a subsequent return contains no relevant information about the probability of a correct forecast, actual returns and predictions about future returns are both treated as dichotomous random variables. Forecasting performance can then be evaluated in a contingency table framework. Based on the theorem in Merton (1981)[2], the authors argue that when market forecasts and subsequent returns are independent (and consequently a forecast has no value), both conditional probabilities of a correct forecast (i.e., the probability of a positive forecast before an up-move plus the probability of a negative forecast followed by a down-move) must add up to 1. Since this is a necessary and sufficient condition, they formulate that a test for independence of both dichotomous variables and hence against forecasting ability is a test whether the sum of conditional probabilities exceed one (or more accurately deviate from one[3]). To test this they employ the Fischer (1935) exact test for independence.

Cumby / Modest (1987) show that this specification is equivalent to a likelihood ratio test in a logistic regression formulation. Let *X(t)* be a binary random variable which takes on the value one in case the advisor under scrutiny predicts an up-movement and zero otherwise. Further, let *Z(t+1)* be again a binary variable which equals one when the subsequent change in price is positive, and zero otherwise. Then assume that the probability distribution of *Z(t+1)* conditional on *X(t)* follows the well known logistic function[4]:

$$\Pr\left[Z(t+1)=1 \middle| X(t)\right] = \frac{\exp(\gamma + \beta X(t))}{1+\exp(\gamma + \beta X(t))} \tag{1}$$

and

$$\Pr\left[Z(t+1)=0 \middle| X(t)\right] = \frac{1}{1+\exp(\gamma + \beta X(t))} \,. \tag{2}$$

2 According to Merton (1981) it is important to consider the conditional probabilities. Take for example, a forecaster who is always bullish: when the market makes only up-movements during the sample time he will be correct with probability one, when the market only goes down he makes a correct forecast with probability zero. Overall, he has no forecasting power though the unconditional probability in the first case is one.

3 When they consistently add up to less than one it means that the forecaster performs consistently badly. Knowledge of this can still be used to form superior forecasts by simply reversing the forecast. Hence, also these forecasts have a positive value.

4 According to the authors the choice of the logistic distribution is not crucial for the equivalence, but more a matter of convenience.

Forming the odds ratio for Z(t)=1 and taking the logarithm of both sides yields the logistic regression model

$$\log \frac{\Pr[Z(t+1)=1]}{\Pr[Z(t+1)=0]} = \gamma + \beta X(t) \tag{3}$$

Under the null hypothesis that the advisor has no forecasting ability, *X(t)* is independent of *Z(t+1)* and therefore $\beta=0$. The authors suggest the likelihood ratio test as the most powerful unbiased test for this hypothesis. Since traders will in general take positions according to their beliefs, traders' net positions (long contracts minus short contracts) can serve as a direct proxy for their forecasts of future market moves.

Cumby and Modest make two additionally relevant points: First, for small to medium sample sizes, this test has only limited power against plausible alternatives. Second, the procedure suffers from an inherent weakness:: In case the true β in (3) is null, the log odds ratio is constant with a mean depending on the mean of the individual sample under investigation. If there are risk factors influencing the equilibrium expected return and consequently also the log odds ratio in (3), a variation over time of those risk factors will cause a change in the contemporaneous mean at time *t*, which will not be caught in γ as long as γ is static. As a consequence, β will be biased away from zero and the null hypothesis will be rejected too often. This holds unless the forecasts and the risk premium are uncorrelated.

Translated to the case of futures markets this poses a substantial problem which many earlier studies ignore: When risk premia exist, the test – employed over a longer horizon – will not only pick up forecasting ability but also risk premium effects. To minimize the impact of a possible risk premium, the test needs either to be reformulated to account for risk effects or, under the assumption that risk influences change slowly enough over time, the time span it is employed over needs to be very short[5].

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[5] To control for influences on returns by systematic risk factors, one needs to specify a model and identify common risk factors. Wang (2003), for instance, measures forecasting ability in his study by regressing futures returns on net positions together with the interest rate, default premia and equity dividend premia. Since the choice of an equilibrium model is crucial for the results and since there is still little agreement on the "right" factors, we believe it is safer to use only very short forecasting horizons.

Trades of speculators last only a very short time, especially in comparison to hedging positions. Ederington / Lee (2002) demonstrate that in the heating oil futures market the portfolio turnover rate of individual speculators varies roughly between 10% and 20% per day. This implies that the complete portfolio is turned over after 5 to 10 days on average. Therefore, if speculators possess any forecasting ability, it is relevant for a very short time scale. Moreover, since speculators can trade every day, their net positions at the end of the day should proxy best for their expectations of changes in prices over the next trading day. Consequently, we use the Henriksson / Merton test in the logit formulation of Cumby and Modest on a one, two, three and four day horizon respectively. After five trading days the next CoT report is available. Additionally, our sample of weekly observations for 15 years is large enough to ensure that the test is sufficiently powerful.

The Commitment of Trader reports not only consist of binary information, such as the buy and sell recommendations of advisors used in the previously mentioned studies, but also by stating speculators' explicit positions, they offer much more detailed and distinct information. Hartzmark (1991) therefore proposed a natural extension which makes use of this additional information. He termed it 'big hit ability'. He argues that it is likely that traders not only simply predict future returns, but also adjust the size of their positions to reflect the strength of their conviction. Taking the additional available information into account and assuming a linear dependence between net positions and subsequent returns he specifies the following model:

$$R(t) = a' + \beta' LS(t) + e(t) \qquad (4)$$

With *LS(t)* being the net positions of speculators and *R(t)* the change in price. The test is based on the coefficient β'.

To have power against the null hypothesis a test must be correctly specified under the alternative hypothesis. Therefore, a test based on (4) depends crucially on linearity between expectations about price movement and the respective net positions. If one allows for risk aversion this may not be a natural assumption, because a rational, utility maximising trader will adjust his beliefs for expected risk before translating it to a position. For example, an investor who is strongly convinced of an upcoming very small positive movement might still be willing to engage in a large long position, though his expectation is only a small movement. On the other hand, when he expects a large future return but is not certain that it will occur in the immediate future, he might want to engage only in a small position to reduce the danger of a high loss if his beliefs fail. As a consequence, the test might not be very powerful. To account for these findings but still use the greater information content of the Commitments of Traders Reports, we employ a second test in the style of Hartzmark's but refrain from a linear specification. We formulate the following logit model:

$$\log\left(\frac{\Pr[Z(t+1)=1]}{\Pr[Z(t+1)=0]}\right) = \alpha^* + \beta^* \cdot RNP(t) \tag{5}$$

with *Z(t+1)* a binary variable which takes on the value one when the market return of the nearby future in the period *t+1* is positive and zero else wise, and *PR[Z(t+1)=1]* the unconditional probability of *Z(t+1)* being equal to one. In recent years, the open interest held by non-commercials has risen significantly in most markets. In order not to bias our results due to a change in the overall size of speculative activity, we adjust the net positions by the total open interest held by speculators in a market. Therefore, *RNP(t)* signifies the relative net positions calculated as

$$RNP(t) = \frac{long\ \ positions(t) - short\ \ positions(t)}{long\ \ pos.(t) + short\ \ pos.(t) + 2 * spread\ \ pos.(t)}, \tag{6}$$

so that *RNP(t)* represents the average percentage of speculative net positions in relation to overall positions. With this specification we are able to make use of the additional information, incorporate risk adjusted expectations yet we do not rely on a strictly linear relationship.

RISK PREMIUM

The second possible source of returns is the flow of risk premia. It compensates speculators for taking up the risk of price fluctuations that hedgers are unable to transfer to one another. The debate as to whether futures prices incorporate a risk premium has a long history and continues to date. For a recent discussion see Gorton / Rouwenhorst (2006) and Erb / Harvey (2006). Theoretically, two concepts give rise to the existence of risk premium flows. According to expected return asset pricing models like the CAPM or the APT, returns on any risky capital asset, including futures markets, depend on that asset's contribution, positive or negative, to the risk of a large and well diversified portfolio of assets. Therefore, only risk which can not be diversified away will be reflected and rewarded in a risk premium. The applicability of these models to commodities is not straight forward. Empirical evidence of reward for systematic risk has been mixed, see, for example, Dusak (1973), Richard / Sundaresan (1981), Carter / Rausser / Schmitz (1983), Black (1976), Baxter / Conine Jr / Tamarkin (1985) and Young (1991).

A second set of models dates back to Keynes (1930) and Hicks (1939). Where hedgers cannot market the claims to their profits, they seek insurance and use futures markets to avoid risk. Accordingly, they are willing to pay a significant premium to speculators in order to entice them to enter the other side of their contractual needs. A speculator will realize a premium as long as he only agrees to enter a futures position when the price is, in his view, set more favourable than the unconditional price. Therefore, the net supply of hedging contracts, commonly referred to as hedging pressure, causes prices to depart from their no-pressure equilibrium and incorporate a premium which can be positive or negative and which diminishes as maturity is approached. Since net hedging can be either short or long, the deviation can be downward, what Keynes termed normal backwardation, or upward, leading to a “normal contango”. Implicitly, under hedging pressure a futures price will not be an unbiased predictor for the expected future spot price. Recent works like Hirshleifer (1988, 1989), Bessembinder (1992), de Roon / Nijman / Veld (2000) find substantial evidence for hedging dependent premiums.

Unlike many earlier studies, which derive their results indirectly using a set of relatively strong assumptions, we explicitly test for the exchange of risk premia. We follow the approach of Chatrath / Liang / Song (1997) in employing the theory of storage as structural model. We then develop our own specification of the model and test for the exchange of a risk premium.

The theory of storage is well established. It is based on the works of Kaldor (1939), Working (1948, 1949), Brennan (1958) and Telser (1958). It explains the relationship between futures and spot prices of a storable commodity in terms of foregone interest for holding the commodity, warehousing costs and a convenience yield according to

$$F(T,t) = S(t)\exp\left[\left(r(t) + w(t) - y(t)\right)\left(T - t\right)\right] \tag{7}$$

where $F(T,t)$ represents the price of the future with maturity T at time t, $S(t)$ is the spot price, $r(t)$ the interest rate, $w(t)$ represent warehousing costs and $y(t)$ convenience yield. Convenience yield reflects implicit benefits from holding the commodity: Physical inventories have a productive value because they smooth production by enabling the producer to meet unexpected demand as well as unanticipated shortages in the commodity supply. The convenience is therefore "the possibility of making use of them the moment they are wanted" [Kaldor (1939)].

The relationship in (7) states that the futures price will ceteris paribus be higher the greater interest rate and storing costs grow and the lower the convenience yield. It is a partial equilibrium. As soon as $F > S*exp[(r+w+y)(T-t)]$, an arbitrageur would buy the commodity on the spot market and sell futures, generating a riskfree profit of $S*exp[(r+w+y)(T-t)] - F$. When the futures price falls below $S*exp[(r+w+y)(T-t)]$ and he owns the commodity, he would sell it on the spot market and buy it back on the futures market, securing a profit of $F - S*exp[(r+w+y)(T-t)]$.

This relationship will only hold as long as there are no additional factors influencing the relationship between futures and spot prices. When a premium is paid – and it is of no importance what is the actual cause of it – the price will drift away from (7) into a new equilibrium. When we express this premium as a fraction of the spot price and denote it by $p(t)$, the formula becomes

$$F(T,t) = S(t)\exp\left[\left(r(t) + w(t) - y(t) - p(t)\right)\left(T - t\right)\right] \tag{8}$$

which leads to

$$\log F(T,t) - \log S(t) = \left[r(t) + w(t) - y(t) - p(t)\right]\left[T - t\right] \tag{9}$$

Now, if speculators as a group indeed consistently earn a premium, we would expect p_t to be positive when speculators have long net positions and negative when they own short net positions[6]. To test this empirically we form the model

$$\log F(3.DF,t) - \log F(NBF,t) = \\ = \hat{\alpha} + \hat{\beta}_1 Tbill(t) + \hat{\beta}_2 \Delta\sigma^2(t) + \hat{\beta}_3 RNP(t) + \varepsilon(t)\,. \tag{10}$$

To show that (10) is indeed appropriate to make inferences on risk premium flows based on the structural equation (9), some further elaborations are necessary. First, instead of spot prices we employ nearby futures prices and calculate the basis as the difference between the third deferred future (which is the fourth shortest maturity) and the nearby futures contract. To take nearby prices instead of spot prices eliminates potential problems associated with the latter[7]. It also allows us to dispense the time to maturity *(T-t),* since the timely difference between the two futures series is constant. The three-month treasury bill rate serves as the observed risk free interest rate and as warehousing costs are assumed to be constant and will be captured in $\hat{\alpha}$, they are therefore not controlled for separately.

Since we have no a priori reason to assume that the convenience yield is uncorrelated with the risk premium in (9), we need to control for it. Convenience yield is not directly observable. However there are a number of both theoretical and empirical findings on the relationship between convenience yield, inventory and volatility of prices which allow us to construct a meaningful proxy. In the following section we will introduce this proxy and demonstrate the suitability of our choice.

It is both intuitive and common practice in empirical work to assume that the marginal convenience yield declines with increases in inventory and that this happens at a decreasing rate [see, for example, Brennan (1958), Telser (1958), Fama / French (1988)]. Hence, inventories could effectively serve as a proxy for convenience yield. But this approach is not

[6] A risk premium is always flowing between long and short positions or vice versa. The question whether speculators as a group earn the premium relates therefore to the question, on which side of the market their net positions are at the moment and in which direction the premium is flowing.

[7] Spot trading has often different delivery conditions than futures trading. Additionally, spot prices are often calculated as an average of some kind, see Miller / Muthuswamy / Whaley (1994), introducing unwanted features, or are simply not available.

without its limitations. As Fama and French note, it is usually unclear how relevant aggregate inventories should be defined. Furthermore, many commodities are produced, consumed and traded internationally, and the accuracy of aggregate inventory data is questionable, if they are available at all.

Therefore, we expand our examination and additionally consider volatility of commodity prices and its relationship to inventories. Under normal conditions spot prices and shorter running futures prices exhibit higher volatility than longer running futures prices, and volatility is a decreasing function of maturity. An explanation is that shocks in demand or supply have large effects on prices for immediate or short-term delivery, while the market expects that they will be smoothed out over time by substitution and production plan adjustments. Hence, they should affect expected future spot prices and therefore futures prices less than actual spot prices, even when the shock is of a permanent nature. This effect was first presented by Samuelson (1965) and carries his name. Fama / French (1988) refine his theory in their analysis of metals prices and suggest that the magnitude of this effect depends on available inventory. At high inventory levels, the change in convenience yield per additional unit of inventory is low. That means that there can be a comparably large response of inventories to shocks without substantially affecting the convenience yield. This in turn smoothes prices for short-term delivery, so that effects on prices will be comparably small. On the other hand, when inventories are already low, the convenience yield rises more quickly as inventories decline further and inventory responses will be tamer. As the dampening effect of inventory responses will be considerably less, spot prices will react much more vigorously to a shock than futures prices.

This relationship has been examined elsewhere. French (1986), for example, using his formula for spot price elasticity, demonstrates that the magnitude of expected price changes is dependent on the level of inventory. This implies that variations in the expected spot price for a particular commodity should be inversely related to the inventory level. More recently Geman / Nguyen (2005) regress volatility of nearby futures returns on world and US stocks of soybeans and find that relations are highly significant for different time periods.

These results encourage us to use a measure based on volatility differences to proxy for convenience yield. More precisely we want to measure the squared difference in weekly realized volatilities of the nearby futures and the third deferred futures series, which we already employ to construct the basis. We use the sum of squared differences of daily log returns according to

$$\Delta\hat{\sigma}^2(t) = \sum_{v\in t}\left(\log\frac{F(NBF,v)}{F(NBF,v-1)} - \log\frac{F(3.DF,v)}{F(3.DF,v-1)}\right)^2 . \tag{11}$$

F_{NBF} refers to prices of the nearby futures contract and $F_{3.DF}$ to prices of the third deferred contract, the contract with the fourth shortest time to maturity. *v* relates to all trading days pertaining to week *t*. In high frequency data analysis, for instance, this is a measure for realized volatility, see Tsay (2005). Furthermore, Campbell et al. (2001) use a similar method of calculating industry and stock specific volatility based on regression residuals. The main benefit of using this volatility estimator - rather than squared deviation of estimated values from the mean - is that this measure does not depend on any price information from previous weeks. This has two important advantages: First, we capture only contemporaneous volatility and not an average spanning several weeks, and second we are not in danger of introducing problems with overlapping data. This might have been the case if the estimation period for the volatility was longer than the weekly frequency of the regression[8]. In case of low inventory, short-term prices will be more volatile than longer termed prices and thus $\Delta\hat{\sigma}^2(t)$ should take on larger positive values. Since in this case a higher convenience yield will be predominant which in turn negatively affects the basis, we expect a negative sign of $\hat{\beta}_2$ in all markets.

The relative net positions *RNP(t)* introduced in the previous chapter serve as an indicator on which side of the market speculative positions are and whether they as a group profit or suffer from a deviation from the expected price according to the theory of storage. Under the null hypothesis of no flow of any risk premium, the corresponding coefficient $\hat{\beta}_3$ in Equation (10) equals zero. That $\hat{\beta}_3$ can be used to test for premium gains can be easily demonstrated. Consider, for example that a premium is caused by positive hedging pressure. Naturally, since someone needs to take the other side of open contracts, speculators will be net short. In this situation speculators will make a gain when the longer dated futures contract is priced above

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8 Overlapping data is encountered when the sampling frequency is greater than the observation or estimation period of a variable in the sample. This introduces serial dependency and causes AR errors. For a more comprehensive treatment of the problem in the face of futures markets, see, for example, Watkins / McAleer (2004).

its neutral level. This causes the basis to be larger and $\hat{\beta}_3$ will hence be negative. Equally, when there is negative hedging pressure, speculators will be net long. They earn a premium if the basis is below its neutral value and $\hat{\beta}_3$ is again negative. Overall, when speculators are on the 'right' side of the market and gain a premium, the coefficient will be negative, regardless of which way the premium actually flows. A positive coefficient, on the other hand, would indicate that they in fact pay a premium, while no significant result would hint to the absence of a consistent premium flow.

V. Empirical Results

Figure 2 graphically depicts speculators' cumulative returns for each commodity approximated as described above. In general, with the exception of Cocoa, Coffee and Oats we see upwards oriented charts, which strongly hints to positive and large realized returns across most markets.

[Insert Figure 2 about here]

The patterns of the individual charts differ significantly from each other. While there are commodities in which speculators seem to earn steadily - as in cotton, for example - the positive outcome in other commodities is mainly due to a number of short "run-up periods" as in corn and wheat, for instance. We can also state that the volatility of earnings varies greatly across markets. This is confirmed by descriptive statistics for the return series, which are presented in Table 2.

[Insert Table 2 about here]

Although we find high volatility in the return series in many cases, the null hypothesis of a t-test that the mean return equals zero can be rejected at different levels of significance in 12 markets. Furthermore, returns are generally highly peaked and partly skewed. Therefore, we calculate the median return and the Wilcoxon rank-sum test for the null hypothesis that the median equals zero. This additionally controls for potential serial correlation in the return series[9]. The results indicate significant positive yields in 15 of 22 commodities, suggesting that speculators are successful in most markets over a longer time span. In fact, we do not find a single negative and significant gain. Since the momentum in the net position series is quite strong and since we have no a priori reason to suspect traders position themselves systematically different on Tuesdays than on any other trading day, we take this as a strong indication of positive speculator performance in most markets. It is consistent with many of the studies mentioned above.

FORECASTING ABILITY

Table 3 presents the results of the test introduced by Cumby and Modest. The logit regressions were run for each market and for time spans of one to four days following each Tuesday, the day of which the CFTC reports trader positions. The first data column of each regression result indicates how many times the futures price went up and how many times it went down during the respective sub-sample. Market movements are taken from the rolling futures series closest to maturity.

[Insert Table 3 about here]

The extremely low values of the McFadden R^2 - which equals one minus the ratio of the log likelihood of the unrestricted model to the intercept only model – demonstrate that in all cases the inclusion of speculators positions brings no real improvements over a logit model which explains prices only by an intercept. Nevertheless, at least in the case of natural gas and gold as well as copper, the hypothesis of a zero coefficient can be rejected on a high level as well as for more than one of the time spans. This indicates that, in these markets, speculator positions had at least some kind of forecasting value for the next days.

[Insert Table 4 about here]

The basic results do not change when the relative size of net positions is taken into consideration and regressed on the binary variable for market movements (as explained earlier). Results are depicted in Table 4. The values of the McFadden R^2 are equally small.

[9] As is well known, in this case independence between returns has to be rejected. As a consequence, the central limit theorem in its simple form, which postulates that the distribution of the mean over samples is normal, is not applicable. Hence, the t-statistic may not be well-behaved and inference may be misleading.

Again, natural gas, gold and copper show significant values over at least two different time periods. Interestingly, the additional information contained in the magnitude of trader net positions reveals some signs of forecasting value in the cotton, rough rice and corn market over at least two distinct horizons.

Overall we can state that we find some limited signs of forecasting ability over the last 15 years in a few commodities such as gold, copper and natural gas. The low goodness of fit of both test specifications speaks a cautioning word that results should not be over-interpreted Although forecasting power seems to be absent in most markets, the results on the natural gas market point in the same direction as the findings of Buchanan / Hodges / Theis (2001).

To compare our results to earlier studies we additionally calculated regressions using actual market movements and net positions as suggested by Hartzmark (1991) (to conserve space results are not included). As expected, the number of significant coefficients is smaller than in the previous specification. As already discussed we suspect that non-linearities may distort results.

RISK PREMIUM FLOW

Before presenting test results, we depict descriptive statistics of the basis for each commodity market in Table 5. The basis was calculated by subtracting the nearby futures price from the price of the third deferred contract. Figures for the whole sample as well as for two sub-samples conditioned on the sign of the contemporaneous speculative net positions are included.

[Insert Table 5 about here]

Most markets were more often in contango than in backwardation, whereas speculators were more often net long then net short. Consistently across all markets, the basis has been higher on average when speculators were net short, which is an initial indication that they profited on average from “riding the term structure curve”. The Wilcoxon rank-sum test confirms, in all cases but orange juice, the significance of that difference .

Again, gold seems to play a role apart from most other commodities for it was in contango during the whole sample period. The reason may be that the above-ground stocks of gold are substantially larger than any flows in demand, thereby causing the convenience yield to be negligible. A similar observation can be made for silver and cocoa, though not so perspicuously.

Table 6 presents results of the test for risk premia gains of speculators according to the model in (10). Autocorrelation and heteroskedasticity-robust standard errors were obtained according to Newey / West (1987).

[Insert Table 6 about here]

F-statistics together with values of the adjusted R^2 suggest a good overall fit. The coefficient of the proxy for convenience yield, $\Delta\hat{\sigma}^2(t)$, has the expected negative sign and is highly significant in 14 of 22 commodity markets. In these markets the convenience yield proxy seems to be a good choice. Next we look at the coefficients of the relative net positions. We find evidence for nearly all commodities that speculators were consistently on the profiting side when the basis deviated from the value the theory of storage predicts. This result is significant in all cases but orange juice. Therefore, the null hypothesis of no consistent risk premium gains needs to be rejected for 21 of 22 markets. In most markets the rejection is at the 1%-level. These results deviate considerably from Chatrath / Liang / Song (1997), who used a similar approach.

ROBUSTNESS

When regressors are correlated with errors the estimation procedure yields biased and inconsistent results. This happens when right hand side variables are not exogenously but endogenously determined, or when measurement errors are involved. As it is inherent in the normal backwardation theory that speculators only enter a market when the basis has reached a value attractive to them, their position taking may actually depend on the basis. Moreover, speculator positions exhibit momentum, hinting to a dependence on own lagged values. A method to deal with endogeneity in this case is to choose instrumental variables which are assumed to be truly exogenous and re-estimate the equations in a two-stage-least-squares framework. To do so, we determine relative net speculative positions, the convenience yield proxy and the 3-month Treasury Bill Rate as the possibly endogenously determined right hand side variables. Therefore, 16 instrumental variables were included: lagged values of all regressors, 11 monthly dummy variables, lagged nearby and deferred futures prices, and lagged values of the basis.

[Insert Table 7 about here]

The estimation output is depicted in Table 7. The number of significant convenience yield coefficients has increased. Though, in the case of four commodities (oats, cotton, lean hogs and copper) net position coefficients are not significantly different from zero and the coefficient of gold is positive. Overall, results are similar to those presented above, confirming the picture of the earlier outcome.

FURTHER THOUGHTS ON MOMENTUM PROFITS

Consistent with previous research, we have acknowledged so far two possible sources of consistent returns for speculators: forecasting ability and risk premium earnings. Though, the behaviour of commodity prices themselves gives room for the presumption that there could be an unrelated third category. A well documented stylized fact of nearly all commodity markets is a strong and persistent positive autocorrelation of returns. This momentum is generally much more salient among commodity markets than among financial markets and could form the basis for a successful application of momentum trading strategies[10]. A number of studies has investigated the past profitability of such strategies. Recent works include Shen / Szakmary / Sharma (2007) and Miffre / Rallis (2007). A profound overview can be found in Schneeweis / Kazemi / Spurgin (2007). Commonly these momentum strategies, even net transaction costs, are found to be mainly workable over short time periods. Thereby, momentum strategies tend to be long in backwardated markets and short in contangoed contracts, coinciding with the normal backwardation theory. These results are reported as being robust over different time periods.

Positive momentum returns do not imply any forecasting ability, just as momentum earnings are not directly linked to risk premium earnings. Nevertheless we have to note that the existence of a risk premium can trigger position taking in a momentum strategy. This is

[10] As an aside, we also note that in the case of commodities momentum does not necessarily violate efficiency. Momentum in commodity futures may be related to transportation and storage issues, see Williamson / Wright (1991). To allow for momentum even when efficiency is assumed would therefore not be an obvious contradiction.

especially pronounced when the reasons for the risk premium, i.e., systematic risk factors or net hedging pressure, are autocorrelated themselves.

The above cited studies suggest that, in the past, certain momentum strategies may well have been profitably and consistently employed. However, we do not know to what extent and how successfully they were actually employed. With our data set there is no possibility of direct analysis. We have to restrict our analysis to the prerequisite of momentum trading: to investigate whether traders' position taking is influenced by past returns. This would suggest that the use of momentum indeed plays a role. In the literature a number of hints are available that this is actually the case. Röthig / Chiarella (2007), for example, point out that positive commodity price changes provoke positive changes in speculators long positions, and that the relation is not linear. Furthermore, Kocagil / Topyan (1997) find that speculators' demand curves are not linearly related to the futures price.

To investigate this issue further we calculate Granger Causality tests between changes of speculative net positions and percentage price changes. Results are depicted in the left panel of Table 8. Across all markets the null hypothesis of no influence of returns on changes on net positions has to be rejected. This confirms that speculators chose their net positions according to past realized price changes. On the other hand, only in very few markets can it be established that there is no influence of net position alterations on price changes. This may be taken as an indication that speculators as a whole do not alone "make the market", consistent with positive risk premium earnings. Since previously mentioned studies suggest that momentum trading rules are connected with backwardation and contango, we repeat the above analysis for alterations in the basis. Results are contained in the right panel of the same table. Position taking seems also to be influenced by changes in the basis. As a consequence, higher momentum returns may be pronounced when there is a larger basis. This is consistent with Gorton / Hayashi / Rouwenhorst (2007), who expect that for some commodities momentum returns are strongly connected to the level of storage, which in turn influences the basis.

After investigating Granger causality we are additionally interested in the direction of the influence. We therefore regress net position changes on the last two lags of percentage price changes, as well as on changes of the basis. Table 9 presents the results. Because actual net positions are not reflected in past prices we should not face an endogeneity problem and can use normal regression techniques. Again autocorrelation and heteroskedasticity-robust standard errors are calculated according to Newey / West (1987). We are well aware that this simple regression is not able to capture non-linearities which might be present. This issue is not investigated further as at this point we are solely interested to investigate the direction of the relationship. The relationship is positive, what is consistent with the appliance of momentum trading. Although these results do not offer an insight on the actual returns related to momentum, they suggest that that speculators as a group indeed exhibit trend following behaviour and use momentum. We suspect that this leads to high and consistent returns, but we have to leave the proof of that to further research.

VI. Conclusion

This paper finds strong indications that large speculators have consistently made profits in many of 22 different commodity markets over the last 15 years. This can be seen as a rational for the growing relative presence of speculators in commodity markets. Two potential sources for these earnings are identified and investigated: forecasting ability and the flow of risk premia. While the outcomes of a number of earlier studies rest on more or less stringent assumptions, this paper directly tests for large speculators' short-term forecasting ability and the flow of risk premia separately. Forecasting ability in this study is measured over four different horizons, spanning one to four days. Weak signs of forecasting power during several time spans can only be found in the natural gas market as well as in the cases of gold and copper. The procedure for testing for risk premium earnings is based on the theory of storage. Convenience yield is approximated using a volatility ratio based on the volatilities of two futures with different maturities. The analysis reveals that speculators consistently inherit flows of risk premia in practically all markets under scrutiny. The notion of normal backwardation is therefore largely supported, indicating that speculators do not bid risk premia to zero. Additionally, positive autocorrelation in most commodity prices suggests momentum returns as an additional third source of earnings. While gains in this field can not be directly assessed, Granger Causality of net positions on past prices and past values of the basis suggests that momentum trading indeed plays a constant role in speculative activity.

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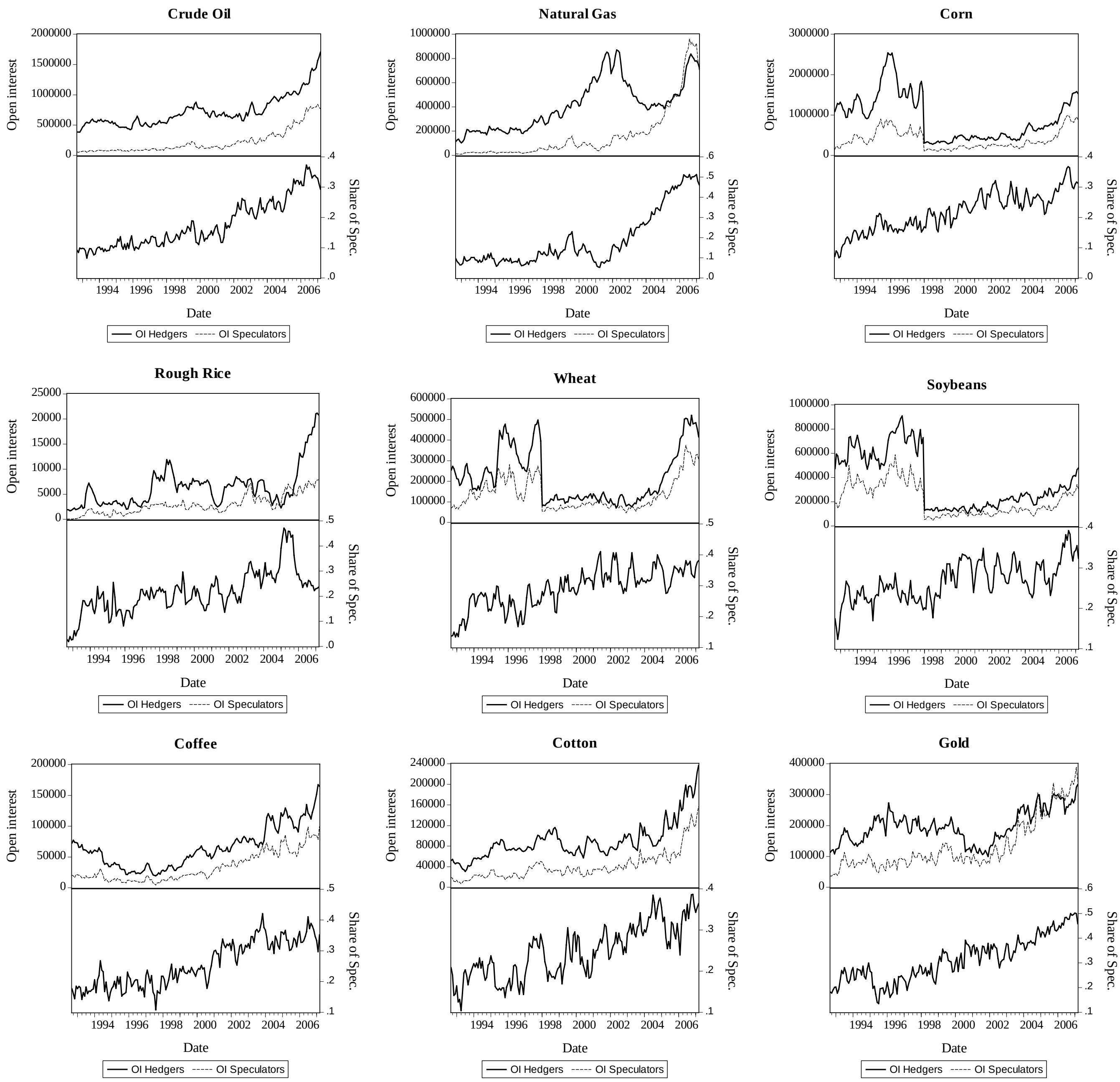
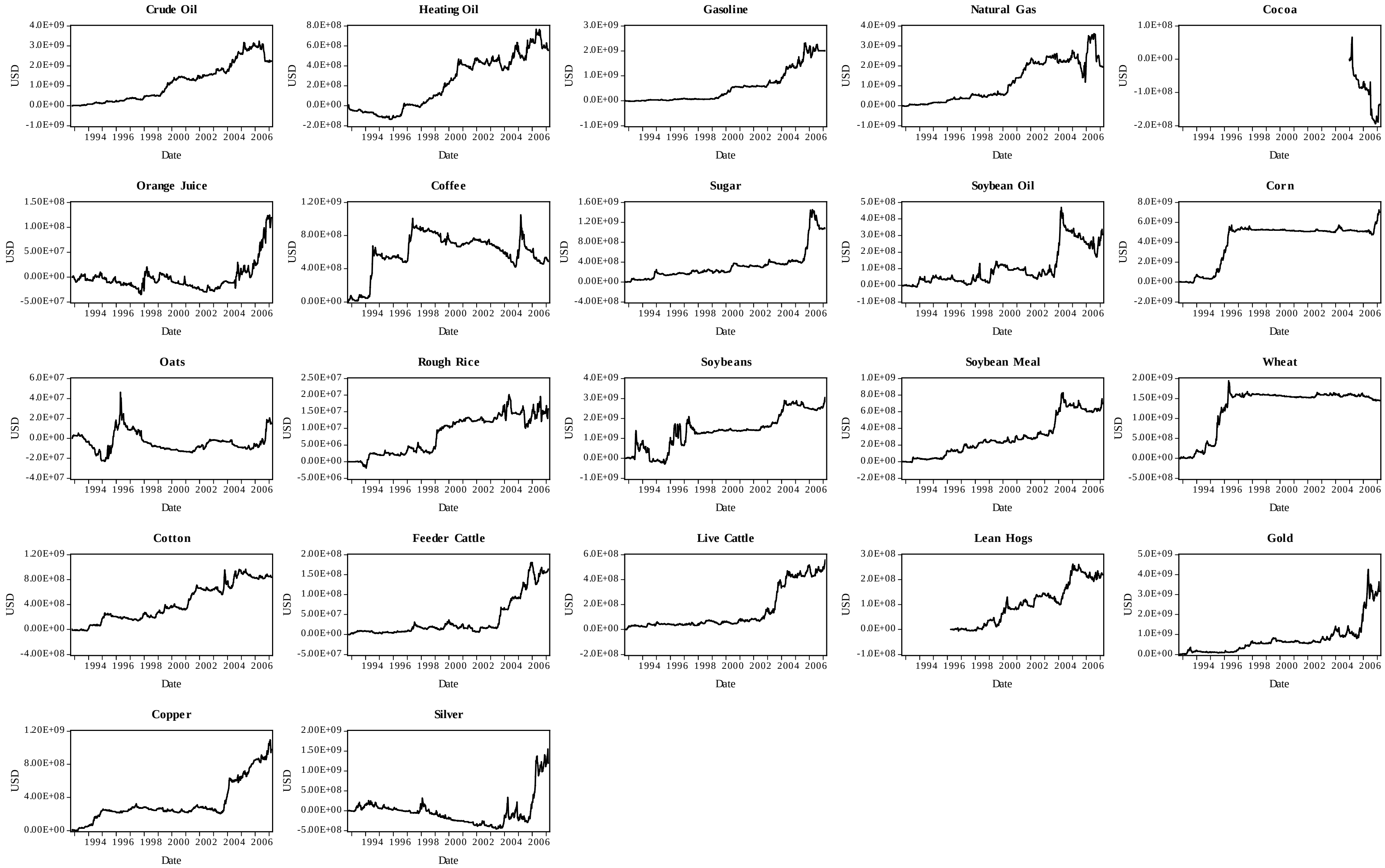
Figure 1:
Development of Open Interest of Commercial and Non-commercial Traders in nine Markets with high trading volume



Note: The upper panel represents the open interest of commercial traders (solid line) and non-commercial traders (dashed line) over time. The lower panel shows the actual share of non-commercial open interest to total interest. The sudden level shifts in corn, wheat and soy bean open interest are due to a contract re-specification.

Figure 2:
Approximation of Cumulative Profits and Losses of Speculative Activity



Note: Weekly profits were calculated as the difference of the average price between two weeks, multiplied with contract size and weekly net positions of non-commercial traders as defined by the Commodity Futures Trading Commission. Prices are calculated as the average of the three futures with the shortest time to maturity. Charts depict cumulative numbers.

Table 1:
Commodity Sample

Commodity	*Sector*	*Symbol*	*Market*	*Contract size*		*Observations in Sample* *First*	*Last*
Crude Oil	Energy	**CL**	NYMEX	1000	barrel	10/1/1992	3/6/2007
Heating Oil	Energy	**HO**	NYMEX	42000	gallons	10/1/1992	3/6/2007
Gasoline	Energy	**HU**	NYMEX	42000	gallons	10/1/1992	10/31/2006
Natural Gas	Energy	**NG**	NYMEX	10000	mmBtu	10/1/1992	3/6/2007
Cocoa	Foodstuff	**CC**	NYBOT	10	metric tons	12/28/2004	3/6/2007
Orange Juice	Foodstuff	**JO**	NYBOT	15000	pounds	10/1/1992	3/6/2007
Coffee	Foodstuff	**KC**	NYBOT	37500	pounds	10/1/1992	3/6/2007
Sugar	Foodstuff	**SB**	NYBOT	112000	pounds	10/1/1992	3/6/2007
Soybean Oil	Grains and Oilseeds	**BO**	CBOT	60000	pounds	10/1/1992	3/6/2007
Corn	Grains and Oilseeds	**C_**	CBOT	5000	bushels	10/1/1992	3/6/2007
Oats	Grains and Oilseeds	**O_**	CBOT	5000	bushels	10/1/1992	3/6/2007
Rough Rice	Grains and Oilseeds	**RR**	CBOT	2000	hundredweight	10/1/1992	3/6/2007
Soybeans	Grains and Oilseeds	**S_**	CBOT	5000	bushels	10/1/1992	3/6/2007
Soybean Meal	Grains and Oilseeds	**SM**	CBOT	100	metric tons	10/1/1992	3/6/2007
Wheat	Grains and Oilseeds	**W_**	CBOT	5000	bushels	10/1/1992	3/6/2007
Cotton	Industrials	**CT**	NYBOT	50000	pounds	10/1/1992	3/6/2007
Feeder Cattle	Livestock and Meats	**FC**	CME	50000	pounds	10/1/1992	3/6/2007
Live Cattle	Livestock and Meats	**LC**	CME	40000	pounds	10/1/1992	3/6/2007
Lean Hogs	Livestock and Meats	**LH**	CME	40000	pounds	5/14/1996	3/6/2007
Gold	Metals	**GC**	NYMEX	100	ounces	10/1/1992	3/6/2007
Copper	Metals	**HG**	NYMEX	25000	pounds	10/1/1992	3/6/2007
Silver	Metals	**SI**	NYMEX	5000	ounces	10/1/1992	3/6/2007

Table 2:
Descriptive Statistics of Approximated Profits and Losses

Sector	*Commodity*	*Number of oberservations*	*Mean Profit (t-stat.)*	*Standard deviation*	*Median (Wilcoxon stat.)*	*Skewness*	*Kurtosis*
Energy	Crude Oil	749	2,993,199 (2.25) **	36,414,814	961,653 (3.69) ***	-0.46	11.19
	Heating Oil	749	742,952 (1.57)	12,935,851	274,799 (2.62) ***	-0.32	14.15
	Gasoline	724	2,777,252 (2.34) **	31,966,894	515,421 (3.86) ***	0.42	20.73
	Natural Gas	749	2,594,250 (1.07)	66,383,978	834,048 (3.26) ***	-1.17	28.95
Foodstuff	Cocoa	112	-1,215,550 -(1.00)	12,910,120	-101,856 (0.66)	-3.9	27.46
	Orange Juice	749	159,449 (1.26)	3,463,272	27,536 (1.48)	0.75	12.82
	Coffee	749	652,146 (0.90)	19,917,352	165,190 (0.40)	0.72	19.5
	Sugar	749	1,436,347 (2.57) **	15,325,369	226,137 (2.34) **	3.25	33.82
Grains & Oilseeds	Soybean Oil	750	408,020 (1.20)	9,277,955	-303 (0.26)	0.87	11.65
	Corn	750	9,362,783 (3.84) ***	66,717,925	93,569 (2.13) **	1.66	17.17
	Oats	748	19,725 (0.35)	1,529,883	-1,568 (0.08)	1.49	59.46
	Rough Rice	740	21,395 (1.27)	458,024	2,689 (2.22) **	-1.2	21.34
	Soybeans	750	3,814,735 (1.40)	74,616,968	1,200,334 (2.45) **	0.75	19.9
	Soybean Meal	750	933,760 (2.49) **	10,266,381	289,248 (2.97) ***	0.99	17.32
	Wheat	750	1,927,393 (2.18) **	24,238,479	25,787 (0.93)	1.9	26.42
Industrials	Cotton	749	1,122,144 (2.31) **	13,305,412	454,123 (2.61) ***	0.68	24.21
Livestock & Meats	Feeder Cattle	750	218,300 (2.79) ***	2,142,838	52,781 (2.79) ***	0.42	12.09
	Live Cattle	750	743,915 (2.93) ***	6,953,192	136,078 (2.85) ***	0.79	9.1
	Lean Hogs	563	390,031 (1.98) **	4,684,074	103,545 (2.36) **	0.33	6.86
Metals	Gold	750	4,210,332 (1.79) *	64,236,880	902,899 (3.72) ***	-0.5	19.1
	Copper	750	1,303,770 (3.22) ***	11,088,652	464,145 (4.68) ***	-0.78	19.62
	Silver	750	1,596,296 (1.07)	40,895,729	5,071 (1.31)	-1.8	28.02

Note: Null hypothesis of the t-Test is that the mean equals zero, null hypothesis of the Wilcoxon rank sum-test is that the median equals zero. *, **, and *** denote significance at a 10%, 5% and 1% level respectively.

Table 3:
Results of Logit Regression for Forecasting Ability of Speculators: Binary Net Positions

		1 day forecast			*2 day forecast*			*3 day forecast*			*4 day forecast*		
Sector	*Commodity*	*Market up/ down*	*β (SE)*	*McFadden R^2 (LR-stat.)*	*Market up/ down*	*β (SE)*	*McFadden R^2 (LR-stat.)*	*Market up/ down*	*β (SE)*	*McFadden R^2 (LR-stat.)*	*Market up/ down*	*β (SE)*	*McFadden R^2 (LR-stat.)*
Energy	Crude Oil	381/	0.05	0.00	402/	0.22	0.00	422/	0.24	0.00	421/	0.14	0.00
		364	(0.15)	(0.12)	343	(0.15)	(2.10)	323	(0.15)	(2.53)	324	(0.15)	(0.86)
	Heating Oil	392/	-0.08	0.00	403/	0.10	0.00	401/	0.09	0.00	383/	0.25	0.00
		353	(0.15)	(0.31)	342	(0.15)	(0.46)	344	(0.15)	(0.32)	362	(0.15) *	(2.75) *
	Gasoline	391/	-0.09	0.00	398/	0.03	0.00	406/	0.19	0.00	399/	0.11	0.00
		341	(0.19)	(0.24)	334	(0.19)	(0.02)	326	(0.19)	(0.99)	332	(0.19)	(0.33)
	Natural Gas	368/	0.53	0.01	339/	0.29	0.00	368/	0.27	0.00	363/	0.17	0.00
		377	(0.15) ***	(12.75) ***	406	(0.15) *	(3.82) *	377	(0.15) *	(3.27) *	382	(0.15)	(1.34)
Foodstuff	Cocoa	69/	0.23	0.00	64/	-0.49	0.01	61/	-0.13	0.00	51/	-0.82	0.02
		43	(0.49)	(0.22)	48	(0.51)	(0.98)	51	(0.49)	(0.07)	61	(0.50) *	(2.79) *
	Orange Juice	386/	0.13	0.00	394/	0.12	0.00	387/	0.09	0.00	371/	0.09	0.00
		359	(0.16)	(0.68)	351	(0.16)	(0.55)	358	(0.16)	(0.31)	374	(0.16)	(0.31)
	Coffee	393/	-0.11	0.00	386/	-0.08	0.00	365/	-0.08	0.00	345/	-0.23	0.00
		352	(0.15)	(0.51)	358	(0.15)	(0.31)	380	(0.15)	(0.26)	400	(0.15)	(2.27)
	Sugar	389/	-0.04	0.00	394/	-0.14	0.00	415/	-0.06	0.00	417/	0.13	0.00
		356	(0.16)	(0.08)	350	(0.16)	(0.77)	330	(0.16)	(0.16)	328	(0.16)	(0.65)
Grains & Oilseeds	Soybean Oil	382/	0.28	0.00	368/	0.12	0.00	366/	-0.12	0.00	365/	0.09	0.00
		364	(0.16) *	(3.20) *	378	(0.15)	(0.55)	380	(0.15)	(0.57)	381	(0.15)	(0.34)
	Corn	394/	0.13	0.00	383/	0.22	0.00	357/	0.29	0.00	352/	0.01	0.00
		352	(0.15)	(0.69)	363	(0.15)	(2.14)	389	(0.15) *	(3.58) *	394	(0.15)	(0.01)
	Oats	405/	-0.26	0.00	387/	-0.49	0.00	380/	-0.07	0.00	392/	-0.34	0.00
		341	(0.24)	(1.19)	359	(0.24) **	(4.10) *	366	(0.24)	(0.09)	354	(0.24)	(2.01)
	Rough Rice	381/	-0.20	0.00	368/	-0.17	0.00	373/	-0.04	0.00	362/	0.05	0.00
		364	(0.15)	(1.89)	377	(0.15)	(1.38)	372	(0.15)	(0.07)	383	(0.15)	(0.13)
	Soybeans	378/	0.28	0.00	373/	0.10	0.00	376/	0.14	0.00	349/	0.19	0.00
		368	(0.16) *	(3.28) *	373	(0.16)	(0.39)	370	(0.16)	(0.87)	397	(0.16)	(1.53)
	Soybean Meal	370/	-0.02	0.00	373/	0.15	0.00	365/	0.11	0.00	379/	0.20	0.00
		376	(0.16)	(0.02)	373	(0.16)	(0.90)	381	(0.16)	(0.50)	367	(0.16)	(1.55)
	Wheat	361/	-0.23	0.00	330/	-0.05	0.00	345/	-0.03	0.00	353/	0.02	0.00
		385	(0.15)	(2.34)	416	(0.15)	(0.11)	401	(0.15)	(0.05)	393	(0.15)	(0.02)
Industrials	Cotton	376/	0.01	0.00	368/	0.26	0.00	373/	0.30	0.00	387/	0.08	0.00
		369	(0.15)	(0.01)	377	(0.15) *	(3.12) *	372	(0.15) **	(4.16) **	358	(0.15)	(0.31)
Livestock & Meats	Feeder Cattle	346/	-0.18	0.00	355/	-0.23	0.00	373/	0.01	0.00	390/	-0.04	0.00
		400	(0.17)	(1.07)	391	(0.17)	(1.81)	373	(0.17)	(0.01)	356	(0.17)	(0.06)
	Live Cattle	372/	0.01	0.00	376/	0.04	0.00	388/	0.15	0.00	391/	0.14	0.00
		374	(0.18)	(0.00)	370	(0.18)	(0.04)	358	(0.18)	(0.72)	355	(0.18)	(0.63)
	Lean Hogs	286/	-0.06	0.00	296/	0.05	0.00	315/	0.09	0.00	314/	-0.12	0.00
		273	(0.18)	(0.11)	263	(0.18)	(0.07)	244	(0.18)	(0.26)	245	(0.18)	(0.41)
Metals	Gold	364/	0.39	0.01	376/	0.15	0.00	380/	0.43	0.01	372/	0.29	0.00
		381	(0.15) ***	(7.04) ***	369	(0.15)	(1.07)	365	(0.15) ***	(8.53) ***	373	(0.15) **	(3.88) **
	Copper	390/	0.23	0.00	407/	0.40	0.01	405/	0.40	0.01	377/	0.47	0.01
		355	(0.15)	(2.23)	338	(0.15) ***	(6.69) *	340	(0.15) ***	(6.91) ***	368	(0.15) ***	(9.47) ***
	Silver	398/	0.03	0.00	402/	-0.03	0.00	392/	-0.43	0.00	375/	-0.44	0.00
		347	(0.29)	(0.01)	343	(0.29)	(0.01)	353	(0.29)	(2.16)	370	(0.29)	(2.32)

Note: For each commodity regressions were built using a binary variable indicating a long or short net position of speculators (exogenous variables) and a binary variable indicating the subsequent positive or negative market movement (endogenous variable). SE is the standard error. McFadden's R square compares the likelihood of a model with the intercept only to the likelihood of the model under consideration. LR is the likelihood ratio test for the joint hypothesis that all slope coefficients are zero. Stars next to the value of the SE indicate significance of the z-statistic for the null that β equals zero. *, **, *** denote significance at the 10%, 5% and 1% level respectively.

Table 4:
Results of Logit Regression for Forecasting Ability of Speculators: Relative Net Positions

		1 day forecast			*2 day forecast*			*3 day forecast*			*4 day forecast*		
Sector	*Commodity*	*Market up/ down*	*β* (SE)*	*McFadden R^2 (LR-stat.)*	*Market up/ down*	*β* (SE)*	*McFadden R^2 (LR-stat.)*	*Market up/ down*	*β* (SE)*	*McFadden R^2 (LR-stat.)*	*Market up/ down*	*β* (SE)*	*McFadden R^2 (LR-stat.)*
Energy	Crude Oil	381/	-0.04	0.00	402/	0.55	0.00	422/	0.95	0.01	421/	0.34	0.00
		364	(0.36)	(0.01)	343	(0.36)	(2.40)	323	(0.36) ***	(6.91) ***	324	(0.36)	(0.92)
	Heating Oil	392/	-0.16	0.00	403/	0.24	0.00	401/	0.22	0.00	383/	0.33	0.00
		353	(0.28)	(0.30)	342	(0.28)	(0.74)	344	(0.28)	(0.61)	362	(0.28)	(1.37)
	Gasoline	391/	-0.44	0.00	398/	-0.12	0.00	406/	0.13	0.00	399/	0.05	0.00
		341	(0.26) *	(2.87) *	334	(0.26)	(0.21)	326	(0.26)	(0.25)	332	(0.26)	(0.03)
	Natural Gas	368/	0.90	0.01	339/	0.61	0.01	368/	0.37	0.00	363/	0.51	0.00
		377	(0.25) ***	(12.86) ***	406	(0.25) **	(5.98) *	377	(0.25)	(2.22)	382	(0.25) **	(4.26) **
Foodstuff	Cocoa	69/	-0.55	0.00	64/	-1.00	0.01	61/	0.09	0.00	51/	-1.28	0.01
		43	(0.85)	(0.41)	48	(0.85)	(1.40)	51	(0.83)	(0.01)	61	(0.85)	(2.30)
	Orange Juice	386/	0.24	0.00	394/	0.01	0.00	387/	0.05	0.00	371/	-0.13	0.00
		359	(0.23)	(1.10)	351	(0.23)	(0.00)	358	(0.23)	(0.05)	374	(0.23)	(0.32)
	Coffee	393/	-0.35	0.00	386/	0.04	0.00	365/	0.08	0.00	345/	-0.23	0.00
		352	(0.23)	(2.31)	358	(0.23)	(0.03)	380	(0.23)	(0.13)	400	(0.23)	(0.95)
	Sugar	389/	-0.03	0.00	394/	-0.09	0.00	415/	0.01	0.00	417/	0.12	0.00
		356	(0.16)	(0.05)	350	(0.16)	(0.30)	330	(0.17)	(0.01)	328	(0.17)	(0.55)
Grains & Oilseeds	Soybean Oil	382/	0.49	0.00	368/	0.11	0.00	366/	-0.26	0.00	365/	0.18	0.00
		364	(0.27) *	(3.24) *	378	(0.27)	(0.16)	380	(0.27)	(0.94)	381	(0.27)	(0.43)
	Corn	394/	0.24	0.00	383/	0.59	0.01	357/	0.86	0.01	352/	0.39	0.00
		352	(0.25)	(0.89)	363	(0.25) **	(5.61) *	389	(0.25) ***	(11.61) ***	394	(0.25)	(2.46)
	Oats	405/	-0.53	0.00	387/	-0.17	0.00	380/	0.11	0.00	392/	-0.33	0.00
		341	(0.25) **	(4.66) **	359	(0.24)	(0.49)	366	(0.24)	(0.20)	354	(0.25)	(1.84)
	Rough Rice	381/	-0.42	0.00	368/	-0.37	0.00	373/	-0.01	0.00	362/	0.25	0.00
		362	(0.21) **	(3.89) **	375	(0.21) *	(3.06) *	370	(0.21)	(0.00)	381	(0.21)	(1.36)
	Soybeans	378/	0.36	0.00	373/	0.27	0.00	376/	0.41	0.00	349/	0.25	0.00
		368	(0.27)	(1.72)	373	(0.27)	(0.98)	370	(0.27)	(2.25)	397	(0.27)	(0.84)
	Soybean Meal	370/	0.09	0.00	373/	0.26	0.00	365/	0.30	0.00	379/	0.44	0.00
		376	(0.28)	(0.11)	373	(0.28)	(0.90)	381	(0.28)	(1.18)	367	(0.28)	(2.53)
	Wheat	361/	-0.44	0.00	330/	-0.03	0.00	345/	0.19	0.00	353/	0.26	0.00
		385	(0.29)	(2.29)	416	(0.29)	(0.01)	401	(0.29)	(0.44)	393	(0.29)	(0.79)
Industrials	Cotton	376/	0.05	0.00	368/	0.31	0.00	373/	0.38	0.00	387/	0.19	0.00
		369	(0.17)	(0.09)	377	(0.17) *	(3.30) *	372	(0.17) **	(4.82) **	358	(0.17)	(1.23)
Livestock & Meats	Feeder Cattle	346/	-0.36	0.00	355/	-0.36	0.00	373/	-0.09	0.00	390/	-0.02	0.00
		400	(0.30)	(1.46)	391	(0.30)	(1.44)	373	(0.30)	(0.10)	356	(0.30)	(0.00)
	Live Cattle	372/	-0.04	0.00	376/	-0.30	0.00	388/	0.08	0.00	391/	0.01	0.00
		374	(0.35)	(0.01)	370	(0.35)	(0.74)	358	(0.35)	(0.05)	355	(0.35)	(0.00)
	Lean Hogs	286/	-0.31	0.00	296/	-0.31	0.00	315/	0.08	0.00	314/	-0.11	0.00
		273	(0.34)	(0.82)	263	(0.34)	(0.81)	244	(0.34)	(0.05)	245	(0.34)	(0.11)
Metals	Gold	364/	0.50	0.01	376/	0.13	0.00	380/	0.45	0.01	372/	0.31	0.00
		381	(0.20) **	(6.43) **	369	(0.19)	(0.47)	365	(0.20) **	(5.23) **	373	(0.20)	(2.54)
	Copper	390/	0.25	0.00	407/	0.58	0.01	405/	0.55	0.01	377/	0.51	0.01
		355	(0.20)	(1.57)	338	(0.20) ***	(8.08) *	340	(0.20) ***	(7.32) ***	368	(0.20) **	(6.48) **
	Silver	398/	0.03	0.00	402/	-0.07	0.00	392/	-0.01	0.00	375/	-0.12	0.00
		347	(0.31)	(0.01)	343	(0.31)	(0.05)	353	(0.31)	(0.00)	370	(0.31)	(0.16)

Note: For each commodity regressions were built using net positions relative to total speculative open interest (exogenous variables) and a binary variable indicating subsequent positive or negative market movements (endogenous variable). SE is the standard error. McFadden's R square compares the likelihood of a model with the intercept only to the likelihood of the model under consideration. LR is the likelihood ratio test for the joint hypothesis that all slope coefficients are zero. Stars next to the value of the SE indicate significance of the z-statistic for the null that β equals zero. *, **, *** denote significance at the 10%, 5% and 1% level respectively.

Table 5:
Descriptive Statistics of the Basis conditional on Net Positions of Speculators

		Unconditional					*When large spec. are net short*			*When large spec. are net long*			
		Number of	*Number of weeks in*				*Number of*			*Number of*			*Wilcoxon*
Sector	*Commodity*	*observations*	*backward.*	*contango*	*Mean*	*Std. dev.*	*observations*	*Mean*	*Std. dev.*	*observations*	*Mean*	*Std. dev.*	*rank-sum test*
Energy	Crude Oil	753	448	305	-0.0125	0.0435	297	0.0084	0.0411	456	-0.0262	0.0395	10.88 ***
	Heating Oil	753	298	455	-0.0038	0.0594	283	0.0158	0.0489	470	-0.0156	0.0620	6.58 ***
	Gasoline	727	429	298	-0.0156	0.0702	144	0.0388	0.0655	583	-0.0291	0.0647	9.66 ***
	Natural Gas	753	276	477	0.0092	0.1312	366	0.0413	0.1067	387	-0.0212	0.1445	7.92 ***
Foodstuff	Cocoa	114	0	114	0.0462	0.0148	21	0.0557	0.0077	93	0.0441	0.0152	3.98 ***
	Orange Juice	753	140	613	0.0496	0.0487	235	0.0540	0.0470	518	0.0477	0.0493	1.64
	Coffee	753	177	576	0.0362	0.0815	288	0.0642	0.0657	465	0.0189	0.0855	8.11 ***
	Sugar	753	448	305	-0.0220	0.0738	238	0.0159	0.0825	515	-0.0395	0.0621	9.80 ***
Grains & Oilseeds	Soybean Oil	753	203	550	0.0119	0.0356	253	0.0324	0.0212	500	0.0015	0.0370	12.48 ***
	Corn	753	116	637	0.0573	0.0786	263	0.0884	0.0445	490	0.0406	0.0874	8.73 ***
	Oats	752	211	541	0.0237	0.1063	81	0.0559	0.0693	671	0.0198	0.1093	2.99 ***
	Rough Rice	747	153	594	0.0502	0.0866	324	0.0649	0.0976	423	0.0390	0.0753	5.80 ***
	Soybeans	753	263	490	-0.0019	0.0580	251	0.0141	0.0431	502	-0.0099	0.0627	6.06 ***
	Soybean Meal	753	385	368	-0.0149	0.0604	236	0.0203	0.0296	517	-0.0309	0.0639	12.56 ***
	Wheat	753	229	524	0.0324	0.0886	337	0.0715	0.0670	416	0.0008	0.0914	11.46 ***
Industrials	Cotton	753	146	607	0.0387	0.0789	426	0.0580	0.0451	327	0.0136	0.1028	5.63 ***
Livestock & Meats	Feeder Cattle	753	344	409	-0.0029	0.0349	181	0.0084	0.0345	572	-0.0064	0.0343	4.96 ***
	Live Cattle	753	373	380	-0.0036	0.0631	166	0.0372	0.0361	587	-0.0152	0.0644	9.94 ***
	Lean Hogs	571	256	315	0.0151	0.1589	188	0.0452	0.1738	383	0.0004	0.1491	3.03 ***
Metals	Gold	753	0	753	0.0177	0.0074	318	0.0199	0.0058	435	0.0161	0.0081	6.91 ***
	Copper	753	378	375	-0.0197	0.0492	269	0.0050	0.0346	484	-0.0334	0.0508	11.35 ***
	Silver	753	21	732	0.0203	0.0113	53	0.0300	0.0091	700	0.0196	0.0111	6.55 ***

Note: Basis was measured as the third deferred minus the nearby futures price. Null hypothesis of the Wilcoxon rank-sum test is that both sub-samples are drawn from the same population. *, **, *** denote significance at the 10%, 5% and 1% level respectively.

Table 6:
Risk Premia Gains: Least Squares Results

Sector	*Commodity*	*No. obs.*	*Adj,* R^2 *(F-stat.)*	$\Delta\sigma^2(t)$ *(Std. dev.)*	*Tbill(t) (Std. dev.)*	*RNP(t) (Std. dev.)*	*Const. (Std. dev.)*
Energy	Crude Oil	752	0.2387	-3,202.27	0.42	-9.67	-1.89
			(0.0000) ***	(1486.03) **	(0.21) **	(1.22) ***	(0.79) **
	Heating Oil	752	0.2002	-2,536.46	0.46	-6.45	-0.90
			(0.0000) ***	(544.66) ***	(0.32)	(1.47) ***	(1.35)
	Gasoline	726	0.1954	47.98	-0.17	-10.77	1.87
			(0.0000) ***	(106.96)	(0.38)	(1.84) ***	(1.84)
	Natural Gas	752	0.1387	-261.56	0.35	-15.84	0.85
			(0.0000) ***	(152.19) *	(0.64)	(3.04) ***	(2.51)
Foodstuff	Cocoa	114	0.3932	-383.71	0.75	-2.97	2.21
			(0.0000) ***	(288.23)	(0.26) ***	(0.75) ***	(1.16) *
	Orange Juice	752	0.0285	-168.83	-0.50	0.45	6.91
			(0.0000) ***	(54.56) ***	(0.25) **	(1.28)	(0.89) ***
	Coffee	752	0.3085	-599.09	-2.00	-7.67	12.76
			(0.0000) ***	(260.18) **	(0.34) ***	(1.91) ***	(1.02) ***
	Sugar	752	0.1673	25.70	0.43	-6.88	-2.30
			(0.0000) ***	(151.17)	(0.45)	(1.41) ***	(1.66)
Grains & Oilseeds	Soybean Oil	753	0.4842	-5,626.16	0.56	-4.76	0.22
			(0.0000) ***	(1063.35) ***	(0.16) ***	(0.74) ***	(0.65)
	Corn	753	0.2288	-454.49	0.16	-11.82	7.15
			(0.0000) ***	(166.95) ***	(0.3)	(2.4) ***	(1.04) ***
	Oats	752	0.2170	-464.82	2.32	-5.97	-3.99
			(0.0000) ***	(109.25) ***	(0.63) ***	(1.87) ***	(3.04)
	Rough Rice	743	0.0426	-197.34	-0.69	-3.88	8.02
			(0.0000) ***	(168.86)	(0.5)	(2.23) *	(2.16) ***
	Soybeans	753	0.3220	-2,107.63	1.16	-4.39	-3.63
			(0.0000) ***	(459.09) ***	(0.29) ***	(1.29) ***	(1.29) ***
	Soybean Meal	753	0.3965	-2,220.43	0.95	-8.29	-3.29
			(0.0000) ***	(635.69) ***	(0.26) ***	(1.18) ***	(1.12) ***
	Wheat	753	0.3125	-924.20	0.78	-17.69	2.15
			(0.0000) ***	(271.62) ***	(0.4) **	(2.6) ***	(1.39)
Industrials	Cotton	752	0.1912	-525.57	-1.75	-4.85	10.68
			(0.0000) ***	(174.71) ***	(0.49) ***	(1.43) ***	(1.77) ***
Livestock & Meats	Feeder Cattle	753	0.1747	-319.65	0.78	-3.72	-2.66
			(0.0000) ***	(618.25)	(0.22) ***	(1) ***	(0.99) ***
	Live Cattle	753	0.1781	-11.65	0.58	-11.24	-0.78
			(0.0000) ***	(130.38)	(0.4)	(2.18) ***	(1.85)
	Lean Hogs	566	0.0241	69.39	-0.29	-9.67	3.74
			(0.0008) ***	(60.87)	(0.88)	(5.55) *	(3.77)
Metals	Gold	753	0.7537	-5,378.66	0.45	0.58	-0.01
			(0.0000) ***	(1439.79) ***	(0.02) ***	(0.11) ***	(0.08)
	Copper	753	0.2157	-4,954.48	-0.40	-3.90	0.85
			(0.0000) ***	(1316.5) ***	(0.23) *	(0.8) ***	(0.93)
	Silver	753	0.3829	-1,969.50	0.29	-1.50	1.53
			(0.0000) ***	(2047.14)	(0.05) ***	(0.4) ***	(0.31) ***

Note: Dependent variable is the basis measured as the third deferred minus the nearby futures price x100. $\Delta\sigma^2(t)$ is the volatility ratio as proxy for convenience yield as stated in the text, *Tbill(t)* is the three month treasury bill rate, *RNP(t)* the relative net positions of speculators. *, **, *** denote significance at the 10%, 5% and 1% level respectively.

Table 7:
Risk Premia Gains: Two-Stage-Least-Squares Results

Sector	*Commodity*	*No. obs.*	*Adj, R^2*	*$\Delta\sigma^2(t)$ (Std. dev.)*	*Tbill(t) (Std. dev.)*	*RNP(t) (Std. dev.)*	*Const. (Std. dev.)*
Energy	Crude Oil	750	-0.3161	-14388.8800	0.5577	-11.4808	-0.4717
				(3145.229) ***	(0.2156) ***	(1.8091) ***	(0.8334)
	Heating Oil	750	NA	-14826.6300	0.3566	-4.5834	3.0322
				(3518.584) ***	(0.3026)	(1.5572) ***	(1.1642) ***
	Gasoline	724	-0.3650	3013.0960	-0.0875	-12.3484	0.1944
				(1466.282) **	(0.3905)	(2.1542) ***	(2.2635)
	Natural Gas	750	-0.3772	-1675.9880	0.4116	-15.7434	3.7275
				(704.3269) **	(0.6436)	(3.1159) ***	(2.8495)
Foodstuff	Cocoa	113	0.3601	-1176.8960	0.7501	-3.1685	2.3423
				(1372.64)	(0.2665) ***	(0.7601) ***	(1.1275) **
	Orange Juice	750	-0.1298	-1175.3660	-0.4305	0.5393	7.1250
				(633.654) *	(0.2481) *	(1.3102)	(0.9068) ***
	Coffee	750	-0.0242	-2594.3720	-1.7982	-7.1024	12.8716
				(1832.081)	(0.3368) ***	(1.8061) ***	(1.0109) ***
	Sugar	750	-2.8574	-9458.8260	-0.1131	-9.9115	5.4213
				(3623.806) ***	(0.5566)	(1.9053) ***	(2.8947) *
Grains & Oilseeds	Soybean Oil	752	NA	-16337.5900	0.2237	-3.8540	2.4466
				(5202.322) ***	(0.1574)	(0.9634) ***	(0.7803) ***
	Corn	752	-2.9849	-5325.2130	0.4886	-8.2508	6.8745
				(3847.179)	(0.2506) *	(2.1058) ***	(0.926) ***
	Oats	750	-3.1449	-4877.8510	0.6120	-1.1051	6.2023
				(1566.968) ***	(0.5132)	(2.4647)	(2.7424) **
	Rough Rice	737	-1.3295	-3256.1960	-0.8904	-4.7133	10.8743
				(1368.692) **	(0.5941)	(2.6203) *	(2.5705) ***
	Soybeans	752	NA	-9126.9090	0.7004	-5.1780	-0.1093
				(2509.509) ***	(0.2478) ***	(1.1326) ***	(1.0254)
	Soybean Meal	752	NA	-11076.2400	0.1711	-6.3129	2.1996
				(1961.061) ***	(0.2878)	(1.5393) ***	(1.2162) *
	Wheat	752	-3.6367	-11846.4300	0.5644	-12.7592	7.0130
				(4656.797) **	(0.4249)	(4.8152) ***	(2.3364) ***
Industrials	Cotton	750	-3.3122	-6857.2410	-1.9981	-2.0573	15.4999
				(1937.026) ***	(0.572) ***	(2.0674)	(2.6408) ***
Livestock & Meats	Feeder Cattle	752	-0.7965	-12932.0200	0.5926	-4.8811	-0.4008
				(4464.993) ***	(0.2162) ***	(1.2317) ***	(1.1007)
	Live Cattle	752	-0.6237	-4501.1550	0.2183	-12.9399	2.8146
				(1399.109) ***	(0.4257)	(2.564) ***	(2.1764)
	Lean Hogs	564	-0.0586	505.2470	-0.1575	-7.3721	1.7529
				(514.2056)	(0.8927)	(6.3562)	(4.3393)
Metals	Gold	752	0.5760	-31191.1900	0.4594	0.6474	0.0026
				(21768.23)	(0.0237) ***	(0.1152) ***	(0.0829)
	Copper	752	NA	-31628.6200	0.5596	-1.1947	0.1790
				(7193.761) ***	(0.2234) **	(1.3331)	(0.7002)
	Silver	752	-0.0591	-15849.6500	0.3373	-1.3631	1.4058
				(13313.61)	(0.064) ***	(0.4502) ***	(0.3308) ***

Note: Dependent variable is the basis measured as the third deferred minus the nearby futures price x100. *$\Delta\sigma^2(t)$* is the volatility ratio as proxy for convenience yield as stated in the text, *Tbill(t)* is the three month treasury bill rate, *RNP(t)* the relative net positions of speculators. *, **, *** denote significance at the 10%, 5% and 1% level respectively.

Table 8:
Reaction of Speculative Positions to Changes in Past Prices and Past Basis: Granger Causality

Sector	*Commodity*	*Number of oberservations*	*Price change [%] does not cause net pos change*	*Net pos change does not cause price change [%]*	*Number of oberservations*	*Change in basis does not cause net pos change*	*Net pos change does not cause change in basis*
Energy	Crude Oil	719	130.20 ***	1.97	719	52.54 ***	1.10
	Heating Oil	719	178.03 ***	0.24	719	40.29 ***	2.64 *
	Gasoline	705	164.06 ***	2.25	692	40.34 ***	1.68
	Natural Gas	719	96.76 ***	0.92	719	18.11 ***	0.73
Foodstuff	Cocoa	107	84.33 ***	1.02	107	14.05 ***	3.50 **
	Orange Juice	719	172.92 ***	5.55 ***	719	62.67 ***	13.00 ***
	Coffee	719	166.21 ***	0.72	719	19.65 ***	1.59
	Sugar	719	206.62 ***	2.40 *	719	88.99 ***	2.68 *
Grains & Oilseeds	Soybean Oil	723	306.23 ***	0.21	723	18.91 ***	2.80 *
	Corn	723	143.43 ***	0.81	723	9.11 ***	0.60
	Oats	723	25.83 ***	0.17	719	3.31 **	0.42
	Rough Rice	719	34.00 ***	1.37	704	4.67 ***	1.69
	Soybeans	723	116.59 ***	0.22	723	0.54	1.32
	Soybean Meal	723	215.51 ***	0.04	723	10.95 ***	2.62 *
	Wheat	723	124.56 ***	0.09	723	14.18 ***	0.28
Industrials	Cotton	719	239.78 ***	1.07	719	25.45 ***	0.36
Livestock & Meats	Feeder Cattle	723	103.51 ***	3.21 **	723	27.81 ***	0.21
	Live Cattle	723	111.89 ***	0.88	723	19.25 ***	3.79 **
	Lean Hogs	538	75.67 ***	0.08	538	11.50 ***	0.71
Metals	Gold	719	174.37 ***	0.04	719	1.49	0.08
	Copper	719	204.74 ***	3.07 **	719	46.65 ***	2.73 *
	Silver	719	202.65 ***	0.48	719	32.60 ***	4.59 **

Note: F-statistics of tests for Granger Causality between changes in speculative net positions and percentage price changes, as well as between alterations in speculative net positions and absolute movements of the basis. *, **, *** denote significance at the 10%, 5% and 1% level respectively.

Table 9:
Reaction of Speculative Positions to Changes in Past Prices and Past Basis: Least Square Results

Sector	*Commodity*	*No. obs.*	*Adj, R^2* *(F-stat.)*	Price change [%] *one week ago (*100)* *(Std. Dev.)*	Price change [%] *two weeks ago (*100)* *(Std. Dev.)*	*No. obs.*	*Adj, R^2* *(F-stat.)*	Basis change [abs.] *one week ago (*100)* *(Std. Dev.)*	Basis change [abs.] *two weeks ago (*100)* *(Std. Dev.)*
Energy	Crude Oil	752	0.262	1268.90	536.67	752	0.125	-2713.07	-1590.68
			(134.22) ***	(124.01) ***	(89.48) ***		(54.84) ***	(374.34) ***	(288.58) ***
	Heating Oil	752	0.333	545.45	150.32	752	0.097	-711.10	-353.79
			(188.01) ***	(42.85) ***	(31.82) ***		(41.49) ***	(111.49) ***	(81.85) ***
	Gasoline	752	0.301	456.05	141.04	752	0.100	-502.78	-143.42
			(162.87) ***	(46.90) ***	(25.16) ***		(42.63) ***	(63.55) ***	(52.23) ***
	Natural Gas	752	0.202	422.32	144.42	752	0.050	-309.40	-143.23
			(96.27) ***	(58.11) ***	(35.51) ***		(20.74) ***	(65.71) ***	(42.19) ***
Foodstuff	Cocoa	752	0.062	112.04	73.52	752	0.017	-240.82	-188.73
			(25.71) ***	(33.81) ***	(23.06) ***		(7.60) ***	(99.05) **	(83.90) **
	Orange Juice	752	0.344	193.22	98.68	752	0.156	-314.97	-212.89
			(198.20) ***	(18.05) ***	(12.63) ***		(70.53) ***	(40.38) ***	(35.58) ***
	Coffee	752	0.321	310.32	105.72	752	0.053	-310.77	-233.49
			(178.22) ***	(43.36) ***	(25.26) ***		(21.93) ***	(79.08) ***	(56.41) ***
	Sugar	752	0.365	1239.79	546.74	752	0.202	-1626.02	-847.04
			(216.57) ***	(115.33) ***	(75.00) ***		(96.02) ***	(195.49) ***	(127.70) ***
Grains & Oilseeds	Soybean Oil	752	0.474	1256.18	430.42	752	0.056	-1430.86	-939.53
			(339.38) ***	(85.98) ***	(62.07) ***		(23.28) ***	(269.56) ***	(248.57) ***
	Corn	752	0.297	5747.59	1601.95	752	0.029	-3231.26	-1233.89
			(159.89) ***	(560.34) ***	(385.46) ***		(12.27) ***	(929.28) ***	(726.98) *
	Oats	752	0.061	77.53	50.26	752	0.006	-34.98	-26.46
			(25.39) ***	(17.67) ***	(12.13) ***		(3.26) **	(15.92) **	(10.41) **
	Rough Rice	752	0.081	18.40	6.37	752	0.010	-8.22	-6.81
			(33.88) ***	(3.94) ***	(2.50) **		(4.90) ***	(3.78) **	(3.67) *
	Soybeans	752	0.265	3042.59	877.05	752	NA	-574.96	-113.92
			(136.11) ***	(365.73) ***	(212.64) ***		(0.91)	(394.71)	(363.31)
	Soybean Meal	752	0.384	942.81	154.96	752	0.029	-504.22	1.18
			(235.04) ***	(87.16) ***	(52.34) ***		(12.26) ***	(111.93) ***	(90.94)
	Wheat	752	0.260	1528.27	566.17	752	0.039	-1001.99	-415.21
			(132.60) ***	(150.37) ***	(97.07) ***		(16.40) ***	(193.25) ***	(174.90) **
Industrials	Cotton	752	0.405	831.67	302.19	752	0.057	-409.22	-200.67
			(256.02) ***	(70.39) ***	(46.70) ***		(23.49) ***	(91.93) ***	(57.02) ***
Livestock & Meats	Feeder Cattle	752	0.225	186.05	76.19	752	0.065	-185.44	-34.98
			(110.10) ***	(23.01) ***	(15.27) ***		(27.02) ***	(32.75) ***	(28.54)
	Live Cattle	752	0.230	767.51	277.67	752	0.056	-356.01	-195.19
			(113.38) ***	(98.55) ***	(63.18) ***		(23.33) ***	(72.04) ***	(62.87) ***
	Lean Hogs	752	0.204	230.59	96.14	752	0.038	-69.43	-43.47
			(96.92) ***	(38.22) ***	(24.79) ***		(15.75) ***	(15.90) ***	(14.28) ***
Metals	Gold	752	0.318	3585.82	793.87	752	0.003	-7675.67	-5018.09
			(175.87) ***	(440.52) ***	(314.90) **		(2.07)	(4446.60) *	(4395.22)
	Copper	752	0.355	656.36	160.11	752	0.132	-1198.43	-454.63
			(208.03) ***	(73.48) ***	(49.29) ***		(58.23) ***	(175.24) ***	(104.92) ***
	Silver	752	0.366	862.09	331.44	752	0.083	-5028.13	-2257.89
			(217.29) ***	(99.48) ***	(53.66) ***		(35.00) ***	(1035.46) ***	(626.45) ***

Note: On the left hand side changes in net speculative positions are regressed on percentage price changes of the previous and pre-previous week. On the right hand side changes in net speculative positions are regressed on alterations of the basis, defined as the third deferred minus the nearby futures price. *, **, *** denote significance at the 10%, 5% and 1% level respectively.