Who Trades Futures and How: Evidence from the Heating Oil Futures Market

Louis Ederington
Oklahoma Bankers Professor of Finance
Michael F. Price College of Business
University of Oklahoma
Norman, OK 73019
405-325-5591
lederington@ou.edu

Jae Ha Lee
Professor of Finance
School of Business
Sungkyunkwan University
Seoul, Korea 110-745
82-2-760-0416
jhlee01@dragon.skku.ac.kr

October 2000
Initial draft: April 2000

The authors wish to acknowledge the helpful comments of participants in the Finance Workshop at the University of Oklahoma. They also wish to thank Michael DeWally for technical assistance and Bob Spier for advising on the heating oil industry and for assistance in classifying the energy firms.

Abstract

Who Trades Futures and How: Evidence from the Heating Oil Futures Market

We document the trading activities over the period from June 1993 through March 1997 of the 223 largest traders of heating oil futures - traders who together account for 58% of the open interest in this market. Dividing these traders into eleven different groupings: refiners, marketers/distributors, commercial banks, investment banks, end users, energy traders, other energy firms, commodity pools, commodity trading advisors, floor brokers, and other non-commercial traders, we explore how their trading activities differ and compare. While past studies have documented the trading of a single trader, a single type of trader, or traders in general, this is the first dis-aggregated study of *all* large traders in any derivatives market. We find substantial and significant differences between the eleven trader types in: their propensity to take long or short positions, whether they hold outright (naked) or spread positions, the term-to-maturity of the contracts they hold, how long they hold a position, and the size of their positions. We also find that both trading volume and open interest positions are dominated by potential hedgers, rather than speculators, where potential hedgers are defined as traders with substantial positions in the cash and/or forward heating oil market. Finally, we find that it is not appropriate to treat traders which the CFTC identifies as "commercials" as hedgers as is common practice in the finance literature.

Who Trades Futures and How: Evidence from the Heating Oil Futures Market

The finance literature contains innumerable prescriptions for how futures markets *could* or *should* be used to reduce or manage risk or to speculate on future price movements. There have also been several studies of actual trading by individual futures traders or by a particular group of traders (floor traders in particular) and several surveys of traders.[1] However, to date, no one has examined a major futures market and documented who is actually trading in that market and how. Seeking to correct this deficiency, we document the trading activities of the 223 largest traders (who collectively account for more than 58% of the average daily open interest) on the heating oil (or #2 fuel oil) futures market, the oldest and one of the largest energy futures markets. Classifying these 223 traders into eleven categories, such as refiners, marketers/distributors, investment banks, commodity pools (or hedge funds) and floor traders, we document how their trading practices compare and differ over the June 1993 - March 1997 period.

Our findings include the following. One, while we cannot identify particular trades as hedges or speculative trades since we cannot observe the spot or forward market counterpart of a trade, the market is dominated by "potential hedgers", i.e., by traders known to have sizable spot or forward market commitments. These potential hedgers account for about 83% of the average daily open interest in our sample and 75% of the trading volume. Fuel oil refiners alone account for about 34% of the open interest and 29% of the trading volume in our sample on average. Two, while the total number of traders numbers in the thousands, open interest and trading are dominated by a relative few. As just mentioned, the 223 largest traders account for over 58% of the total open interest over our period and the 40 largest traders account for about 50%. Three, consistent with classic hedging theories in which refiners use the futures market to lock-in future selling prices and fuel oil users use the

futures market to lock-in a purchase price, we observe that refiners tend to take short positions in futures while fuel oil users tend to be net long. However, there is considerable variation among refiners with several taking long positions at times. Fuel oil marketers/distributors also tend to be net short while banks and commodity pools tend to be net long. Four, instead of being all long or all short, many large traders hold intra-market spread positions, i.e., they simultaneously long some contracts and short others. This is particularly true of floor traders and marketers/distributors. Five, trader groups tend to specialize in different terms-to-maturity. For instance, the time-to-maturity of the average contract held by floor traders is over twice as long as that of the average contract held by commodity pools. Six, as expected, hedgers tend to hold their futures market positions longer than speculators. Floor traders are the most active, turning over 19% of their positions each day, while the refiners' turnover is only 9%. Seven, the CFTC reports open interest positions of two groups of large traders: "commercials" and "non-commercials" which are generally treated in the finance research literature as represeting hedgers and speculators respectively. While it appears fairly accurate to treat non-commercials as speculators, we find that (at least in the energy futures markets) it is not appropriate to regard commercials as hedgers since this group contains many firms with no known energy assets.

The remainder of this paper is organized as follows. In the next section, we describe this market, our data, and our trader classification scheme and then discuss our hypotheses and issues. Results are presented in section II. In III, we discuss each of the trader groups in turn describing the picture of their trading activity which arises from our analysis. Section IV concludes the paper.

I. The Dataset

A. The Market and Data

We explore trading in the futures market for #2 fuel oil, or heating oil, on the New York Mercantile Exchange over the period from June 1, 1993 through March 31, 1997. Established in 1978, this is the oldest energy futures market and one of the most active after crude oil. In addition to heating oil per se, the #2 fuel oil category includes diesel fuel and jet fuel.[2] Each futures contract is for 42,000 gallons, or 1000 barrels, with prices quoted as dollars per gallon. While separate contracts are traded for 18 consecutive months, trading and open interest tend to concentrate in those contracts which provide for delivery in the near future and in the winter months. Prices tend to rise sharply when winter temperatures along the East coast of the US are lower than expected, which in our study period occurred in both the winter of 1996 and the winter of 1997. While smaller than the crude oil futures market, this is an active market with an average open interest over our period of 196,220 contracts or 196,220,000 barrels.

Like the studies by Hartzmark (1987, 1991), Bessembinder (1992), Leuthold et al (1994),and deRoon et al (2000), our study is based on the reports of large traders to the Commodity Futures Trading Commission (CFTC), but, unlike these earlier studies, we are able to identify the traders' lines of business. The CFTC requires brokers to report the end-of-day daily open interest positions of "large traders," which in this market during this period were defined as any trader holding more than 250 contracts (which would correspond to 10,500,000 gallons of heating oil).[3] Reportedly, the CFTC sets the reporting limits, such as the 250 in this market, so as to account for roughly two-thirds of the open interest and, on an average day in our 6/1/93-3/31/97 period, this data set accounts for 65.9% of the total long positions and 76.8% of the total short positions in heating oil futures. To ensure a continuous series for most traders and to reduce our trader classification task, we restricted our data set to those traders whose open interest position in heating oil futures averaged 400 or more contracts.[4]

Applying this cutoff reduced the number of traders from 496 to 223 but these 223 account for more than 80% of the average daily open interest in the original data set and 58% of the total market open interest on an average day.

B. The Trader Classifications

The CFTC classifies reporting traders as "commercials" and "non-commercials" and this division is the level of dis-aggregation used in all previous studies based on this data. In the finance research literature, these two categories are commonly interpreted as representing hedgers and speculators respectively.[5] Based on our examination of the traders in the heating oil futures market, it appears that most traders which the CFTC identifies as non-commercials are indeed speculators but many in the "commercials" group appear to be speculators as well.

A major contribution of the present study is to subdivide the commercial and non-commercial categories of traders into eleven more descriptive subcategories so that we can examine how trading practices are related to a trader's cash and forward market activities. As described in Table 1, these eleven main-line-of-business groupings are: refiners, marketers/distributors/pipelines, commercial banks, investment banks, end users, energy traders, other energy firms, commodity pools and hedge funds, commodity trading advisors, floor traders, and other non-commercial traders. The group assignments were made with the assistance of officials at the Office of Policy of the US Department of Energy in a manner which hid the identity of individual traders from the authors.[6]

The CFTC assigns line-of-business codes to most (but not all) traders and we relied on these to classify the non-commercial traders, but not the commercial traders. The CFTC categorizes non-commercial traders as: commodity pool operators (which includes hedge funds), commodity trading advisors, futures commission merchants, floor brokers, and floor traders.[7] We combine the last three: floor traders, floor brokers, and futures commission merchants into a single "floor traders" classification

since (regardless of their primary activity) the trades in our data set represent trades for their own account, i.e., their activity as floor traders. Trades executed by floor brokers or futures commission merchants for their customers are attributed to the customer in the CFTC database. There were a number of non-commercial traders with no code on the CFTC tapes. We classify these as "other non-commercial." The CFTC informed us that these were generally large individual "off-the-floor" traders and our searches confirmed this for all we could identify.

Unlike their non-commercial trader classification codes, the CFTC's codes for commercial traders, such as: "producer/feeder of livestock", "other producer", "merchant or dealer", "processor", and "end user/ consumer," were not meaningful for this market. With the assistance of the Office of Policy of the US Department of Energy we assigned all commercial traders to one of the following categories: (1) refiners, (2) marketers/distributors and pipeline companies, (3) investment banks and brokers, (4) commercial banks, (5) energy traders, (6) other energy and (7) end users according to their primary line-of-business.[8] Marketers/distributors/pipelines are primarily in the business of buying heating oil from refiners and selling to end users. Both investment and commercial banks make markets in energy swaps and other OTC energy products. We separate these two types of banks because we would expect the stricter regulations of commercial banks to preclude any speculation. The "energy traders" category consists of firms with few physical assets which specialize in energy trading. Most of these have off-shore addresses - with the Caymans seeming particularly popular.[9] "Other energy" is a residual group of energy companies consisting mainly of exploration and production companies without refining capacity. The "end users" group is a residual non-energy group but proved to consist entirely of large fuel oil consumers, such as airlines.[10]

While we do not have enough information to label a particular trade as a hedge or a speculation, we know that five of our eleven groups (refiners, marketers/distributors, commercial banks, investment banks, and end-users) have substantial cash or forward market positions in heating

oil or related products which they could be hedging. Accordingly, we label these "potential hedgers." Of these, we are least comfortable with designating investment banks as hedgers. As previously noted, while both investment and commercial banks make markets in energy swaps and other OTC products, we separate the two since regulators of commercial banks should restrict their trades to purely hedging activities while investment banks could be speculating. Nonetheless, investment banks are certainly "potential" hedgers since they do have positions in the swap market.

We expect all four "non-commercial" groups: commodity pools, commodity trading advisors, floor traders, and "other non-commercial", to be engaged primarily in speculation. As noted above, the"energy traders" category within the CFTC's "commercials" group consists mostly of off-shore firms with few physical assets which specialize in energy trading. While they may arrange cash market deals as well, we view most of their futures market activity as largely speculative in nature. The "other energy" category from the "commercials" grouping consists mostly of exploration and production firms without refineries. Since exploration and production firms wanting to lock-in a future sale price of their product would be expected to short crude oil, not heating oil, futures, we think their trades in the heating oil market are likely speculative in nature.[11] Consequently, we view the first five categories in Table 1 as consisting primarily of hedgers (or potential hedgers) and the last six as consisting largely of speculators.

In summary, our examination of heating oil futures traders reveals the impossibility of accurately classifying traders as hedgers or speculators when one cannot observe their simultaneous activities in cash, forward, or swap markets. Without observing the trader's activities in other markets, who can say if a futures trade by an investment banking firm or a professional trader is a hedge or a speculation? Nonetheless, it seems clear that the CFTC's "commercials" and "non-commercials" groupings cannot be interpreted as representing hedgers and speculators respectively since the former grouping includes some traders with no known positions in either the cash market or forward markets.

C. Hypotheses and Questions.

In documenting how the trading practices of these groups differ, we are interested in such questions as: (1) who dominates this market, (2) who is hedging and who is speculating, (3) who is short and who is long, (4) who trades the nearby contracts and who trades the more distant contracts, and (5) how long does each tend to hold a futures market position? In some cases, finance theory provides a testable hypothesis. In some cases, conventional wisdom or anecdotal evidence provides hypotheses which have not been tested heretofore. In others, we have questions but no a priori hypotheses.

We are interested first in whether traders are long or short and what this implies about their trading objectives. In discussions of heating oil futures hedging, the two most common hedge examples are one in which a heating oil refiner locks in a future sale price by shorting futures and one in which a consumer, like an airline, locks in a future buying price by longing futures. Accordingly, we expect the refiners group to be net short and the end user group to be net long. Since, they are expected to be on both sides of forward market transactions, there is no a priori reason to expect the two bank groups and marketers/distributors to be consistently long or short. Instead, we would expect them to tend to hold intra-market spread positions, that is to be simultaneously long some maturities and short others. While there is no a priori reason to expect the six speculator groups to be short or long, the CFTC's "Commitment of Traders" report indicates that non-commercials in general tend to be net long and several market observers told us that they think commodity pools in particular are generally net long.

Hedges can be of long or short duration. Consider a refiner who on June 1 enters into an agreement to buy crude oil in August which he intends to refine and sell as heating oil and other products in September and who hedges this risk by shorting the September heating oil futures on June 1. On the one hand, he might hold this futures market position until September when he sells the

heating oil on the spot market and simultaneously longs the September futures contract shortly before it expires. On the other hand, on June 15 he might enter into an OTC agreement to sell the oil in September. If so, he would long the September futures on June 15 closing his position. Since we would expect most futures trades by the banks and marketers/distributors to be of the latter variety, that is temporary hedges until a balancing transaction can be arranged, we would expect their futures position turnover to exceed that for refiners and end users.

Speculative positions can also be of long or short duration. A speculator who in September thinks that cash market heating oil prices next January will exceed the September price of the January futures will buy the January contract. If she continues to hold this expectation and the futures price does not rise, she may hold until January. However, if she changes her mind or futures prices rise, she may close the position early. Likewise a trader may speculate that the January futures prices will rise next week and so only hold the position for a short period. While speculative positions like hedges can be of long or short duration, the conventional view is that speculators have shorter horizons than hedgers and that this is particularly true of floor traders so we put this conventional wisdom to the test. In summary, we expect OTC market makers (marketers/distributors, investment banks and commercial banks) to hedge for shorter periods than refiners and end users. We will also test the conventional wisdom that speculative trades are of shorter duration than hedges.

Finally, we are interested in who dominates trading and open interest in this market and in whether particular traders tend to trade nearby versus distant contracts or winter versus non-winter contracts. However, we have no particular hypotheses to advance on these issues.

II. Results

A. Who Are the Major Traders?

Measures of the average daily open interest positions held by each of the eleven trader groups are reported in Table 2. It should be kept in mind that these are conditional averages since the sample is restricted to traders whose average daily total open interest is at least 400 contracts.[12] They are also gross positions; for instance, if a trader is long 400 May contracts and short 200 June contracts, this is recorded in Table 2 as an open interest of 600 contracts. As shown in Table 2, firms in the "investment banks" classification tend to hold the largest open interest positions, 3791 contracts per trader on average, which is over twice as large as the average open interest positions of refiners, the group with the second largest average open interest positions, 1781 contracts per trader. However, since there are many more refiners (51) than investment bankers (17), refiners as a group account for more of the total open interest in this sample, 34.1%. Three groups: refiners, marketers/distributors, and investment banks account for over 75% of the average daily open interest held by these very large traders. Potential hedgers, i.e., the first five groups in Table 2 hold about 83% of the contracts in our sample and speculators, the last six groups in Table 2, account for 17%. Clearly the market is dominated by traders with substantial positions in the cash or forward markets for fuel oil.

In Table 2, we also report estimates of the trading volume accounted for by each trader type. While we cannot observe all trades, we can approximate trading volume from the changes in the end-of-day open interest positions. Obviously, this misses trades which are reversed the same day so the figure of 7.5% for floor traders does not include most of the activity of day traders and scalpers. Again the market is dominated by potential hedgers though by this measure the domination is not so overwhelming. Potential hedgers account for 75% of this measure of trading volume and speculators 25%.

While the number of traders of fuel oil futures numbers in the thousands, the market is dominated by a relatively few firms. The 40 largest traders account for roughly 50% of the total open interest in this market and the 10 largest account for more than 25%. The single largest commercial trader held an average of 17,459 contracts during the 6/1-93-3/31/97 period (an average of 5199 long contracts and 12,260 short) which represents a claim to over 733 million gallons of heating oil. These represent 3.8% of all long and 9.0% of all short contracts so over our data period this trader was involved on one side or the other of 12.8% of all heating oil contracts.

B. Long, Short, and Spread Positions.

Evidence on the extent to which actual trading by refiners and end users matches the stereotypical hedges in which a heating oil refiner locks in a future sale price by shorting futures and an end user, such as an airline, locks in a future buying price by longing futures, is presented in Table 3. To obtain the percentages in Table 3, we calculate the percentage of a trader's average total open interest position (longs plus shorts) which consisted of long contracts each day.[13] For each trader, we then calculate an average percentage over the 6/1/93-3/31/97 period. Averages and medians of this ratio for each trader classification are reported in Table 3. While long positions must equal short positions for the market as a whole, this is not the case for the traders in Table 3 since they only constitute 58% of the market.

The figures in Table 3 are roughly consistent with the classic hedge examples. On average, refiners held almost twice as many short contracts, 64.5%, as long, 35.5%. The end user group held six times as many long contracts, 86.7%, as short, 13.3%. Both figures are significantly different from 50% at the .01 level. Besides refiners, marketers/distributors were significantly net short, while commercial banks and commodity pools were significantly net long. The null hypothesis that the percentage of shorts versus longs is the same for all eleven groups is rejected at the .001 level.

An unresolved issue in futures markets which our data could conceivably help answer is whether the futures price is an unbiased estimator of the expected future spot price.[14] The issue turns on whether the futures price is effectively set by hedgers or speculators. If the futures price is determined by rational speculators, then the futures price should be an unbiased estimator of the expected future spot price. That is $F_{t,T} = E_t(S_T)$ where $F_{t,T}$ is the price on day t of a futures contract expiring on day T and S_T is the subsequent day T spot price. However, if most hedgers generally short futures, their trades would tend to push the futures price below the expected future spot price leading to "normal backwardation." On the other hand, if hedgers are net long, their trades could tend to cause $F_{t,T} > E_t(S_T)$. Regardless of these trades by hedgers, if the net speculative demand for futures is perfectly elastic at the expected future cash price, then speculators' trades would move the futures price back to the expected future spot price. However, if speculative demand is not perfectly elastic (i.e., downward sloping), then differences between F_T and $E_t(S_T)$ due to hedging pressures could persist. Along these lines, Ma (1989) reports that in the fuel oil market, the future's price generally exceeded the subsequent spot price over the 1980-86 period, which would be consistent with a market price dominated by long hedgers.

Can our data answer this question? Since we have just seen that speculators account for only about 17% of the average daily open interest and 25% of the trading volume in this market, the question arises whether this is sufficient trading to ensure that $F_{t,T} = E_t(S_T)$. However, we have also just seen that some hedgers, like end users, tend to be net long, while others, like refiners, tend to be net short. Calculated over all five potential hedger categories in Table 3, the percentages are 52.0% short and 48.0% long - in other words roughly balanced. Based on these figures, we would not expect hedging pressure to cause the futures price to differ much from the expected future spot price even if speculators' net demand is not perfectly elastic. Consistent with this, we observe no significant

difference between the futures price and the subsequent spot price over both our data period and the longer 1980-1997 period.

We calculated $F_{t,T} - S_T$ for each contract in our data set defining $F_{t,T}$ as the futures contract with one (also two) month(s) to expiration and S_T as the nearby futures contract just before expiration since arbitration should ensure $F_{T,T}=S_T$.[15] For the 6/93-3/97 period $F_{t,T} - F_{T,T}$ averages -$0.0061 (t=-0.93) when $F_{t,T}$ is measured one month prior to expiration and -$0.0106 (t=-1.22) when $F_{t,T}$ is measured two months prior to expiration. For the 1980-97 period the figures are -$0.0059 (t=-1.44) for one month prior to expiration and -$0.0075 (t=-1.31) for two months prior to expiration. Consequently, the answer to the question of whether hedging pressure can cause $F_{t,T}$ to differ from $E_t(S_T)$ will have to wait for another market and another day.

Since they combine cross-sectional and time-series figures, the figures in columns 2 and 3 in Table 3 on traders' long positions as a percent of their total holdings obscure considerable information on trading practices. Suppose for instance that this percentage is 60% for a particular trader category in Table 3. That could represent any of the following extreme possibilities: (1) 60% of the firms in that category are 100% long all the time and 40% are always short, (2) all firms are 100% long on 60% of the days in our sample and are totally short on 40% of the days, or (3) on all days all firms hold calendar or intra-commodity spread positions in which they simultaneously hold 60% long contracts and 40% short contracts. Or, the figure could represent some combination of these three possibilities - which is the case.

First, there is considerable variation among traders within a group. For instance, although the "%long" average for refiners as a group is 35.5%, the standard deviation is 28.8%. Most refiners hold some long contracts most of the time, many are net long on occasion, and a couple are net long on average.

Second, many large traders hold calendar spread positions. Consider the spread issue. If a trader is speculating on the future direction of heating oil prices or if a hedger is hedging a simple cash or forward market position, then we would expect them to hold pure long or short positions - not spreads. On the other hand, if a hedger is both long and short in the forward or swap market, then we would expect them to hedge this with a spread position. Based on this we would expect the marketers/distributors and the two bank categories to normally hold spread positions. We would also expect a speculator looking for relative mis-pricings to hold spread positions. If for instance, a speculator thinks the January futures price is too high relative to the December and February futures, she would short the January futures and long the other two. Consequently, we would expect floor traders to also normally take spread positions.

To investigate this, for each trader we determine each day whether that trader holds (1) only long contracts, (2) only short contracts, or (3) some of both, i.e., an intra-commodity or calendar spread. We then calculate the percentage of days the trader falls in each category. Averages of these over all traders in each grouping are reported in columns 5-7, which sum to 100%, of Table 3.

As hypothesized, marketers/distributors, investment banks, and floor traders do indeed tend to hold spread positions. Contrary to our hypothesis however, commercial banks do not. Energy traders and the "other energy" group also tend to normally hold spread positions implying that they are largely speculating on price relationships. Interestingly, commodity pools (which includes hedge funds) tend to be either all short or all long. They rarely held spread positions. Since, as we shall see below, these traders tend to specialize in the nearby and second nearby contracts, basically they are speculating on whether heating oil prices will rise or fall in the near future.

One potential problem with the figure in the next-to-last column in Table 3 on how often traders hold calendar spread positions is that it doesn't tell how balanced these positions were. Suppose on a given day, say June 1, a trader was long 1000 July contracts, long 500 August contracts, and short 50

September contracts. This would be counted as a day when the trader held a spread position even though the overall position was overwhelmingly long. Consequently, we construct an index of how evenly balanced a trader's positions were. For each day, this index is measured as:

$$\frac{(\text{total long contracts held} \;\%\; \text{total short contracts held})}{\text{Max}(\text{total long contracts held},\ \text{total short contracts held})} \;\&\; 1.0$$

If on a given day a trader holds an equal number of short and long contracts, then the index equals 1.0. If on a given day, the trader holds only long or only short contracts, then the index equals 0.0. This index may be thought of as the percent of the trader's largest holding (long or short) which are matched or offset by opposite sign holdings. Suppose a trader holds a total of 1400 contracts of which 1000 are long and 400 are short. Of the 1000 long contracts, 40% are offset by short contracts and the spread index equals .40.

The average of this index over all traders within each group is shown in the final column of Table 3. Basically this measure confirms the earlier findings but also adds some new insights. As before, we observe that commodity pools tend to hold outright long or short positions. Relative to the other groups, the positions taken by marketer/distributors and floor traders tend to be the most balanced. Interestingly, the index is fairly low for investment banks implying that, while they usually hold both longs and shorts, their books are not particularly balanced. The null hypothesis that the mean index is the same for all eleven groups is rejected at the .001 level.

C. Contract Maturities

At any point in time, eighteen separate futures contracts are traded calling for heating oil delivery in eighteen succeeding months. For instance, in June 1997 one could long or short contracts for delivery in July 1997, or in August 1997, etc. through December 1998. However, trading and

open interest are normally concentrated in: (1) contracts calling for delivery in the fairly near future,[16] and (2) contracts calling for delivery in the winter months. For instance, for our 223 large traders, on average 40.2% of their open interest positions are in the contracts for the three winter months and 71.4% are in the three shortest maturity contracts.

To determine if the different trader groups tend to specialize in different maturity contracts, we calculate a weighted average maturity for each trader each day. For example, if on May 15 a trader holds 100 June contracts maturing in 20 days and 200 July contracts maturing in 50 days, the weighted average for that day would be [20(100)+50(200)]/300=40 days. Means for the eleven trader groups are reported column 2 in Table 4. As shown there, the holdings of the various trader types differ rather sharply in term-to-maturity. The null that maturity does not differ among trader groups is easily rejected at the .001 level. The discrepancy is particularly wide among the traders generally viewed as speculators. With a weighted average maturity of only 44.2 days, commodity pools appear to be normally speculating on price movements in the short-term. At the other extreme, with an weighted maturity of 107.7 days, floor traders are much more heavily involved with the longer term contracts. The latter figure is encouraging since it appears that floor traders are fulfilling their oft assigned role of providing liquidity in the longer-term contracts where open interest and market liquidity tend to be low.

We also calculate the weighted average maturity separately for long and short positions. Holdings of short positions tend to be of significantly longer duration than long positions holdings for refiners (.01 level), marketers (.05 level), and end users (.01 level). If (as our previous findings indicate) marketer/distributors are using the futures market to offset their forward and swap market positions, these data suggest that in the forward market they are contracting to buy heating oil at fairly long maturities and to sell at somewhat shorter maturities. If one views refiners' short positions as primarily hedges and their long positions as primarily speculative trades, these data indicate that their hedges tend to have a longer horizon than their speculative trades.

In the last column of Table 4, we report the percentage of each group's open interest which is concentrated in the three winter months. Both hedging and speculative interest should be greater for these winter months since the spot price variation from year to year in these months is much higher than for the other nine months. While we have no a priori reason to expect this percentage to be particularly high or low for any group, we are interested in whether or not differences exist. For all trader groups, the percentage of overall open interest in the three winter contracts significantly exceeds the 25% which one would expect if interest were spread evenly over the calendar year. However, while there is considerable variation in this measure from trader to trader, there is no consistent pattern by trader classification. An analysis of variance fails to reject the null hypothesis that there is no difference among the trader groups in their tendency to concentrate their open interest positions in the winter contracts.

D. Turnover.

Finally, attention is turned to the question of how often each of the eleven trader types tends to turn over or revise their positions. As explained above, both hedges and speculative positions can be of short or long duration but conventional wisdom assigns a shorter duration to speculative trades and to floor trader trades in particular. Expecting that OTC market makers, specifically marketers/distributors and the two bank groups, use the futures market as a temporary hedge until a balancing transaction can be arranged, we hypothesized that they would hedge for shorter periods than refiners and end users.

To measure how often traders revise their positions, we calculate a "daily turnover" measure. For each contract held by each trader, this is calculated as the average absolute daily change in a trader's open interest position divided by that trader's average daily open interest position in that contract. Suppose for instance that trader X's holdings of the June heating oil contracts are as follows:

Date	Open Interest	Absolute Change

5/1	100 long	100
5/2	100 long	0
5/3	40 short	140
5/4	0	40
	.	
5/16	100 short	100
5/17	100 short	0
5/18	100 short	0
5/19	0	100

The average daily open interest would be [5(100)+1(40)+2(0)]/8 = 67.5, and the average absolute daily change would be [3(100)+1(140)+1(40)+3(0)]/8 = 60. Note these averages are calculated over all days on which the trader held contracts at either the open or the close, including 5/4 and 5/19, but not days on which the trader held no position at all, e.g., 5/5 through 5/15. For this contract and this trader, the turnover percentage would be 60/67.5 = 88.9%.

This measure is averaged over all contracts on all days for each trader. It provides a measure of how much of the trader's open interest position is changed or "turned-over" on an average day. Note that this "daily turnover" figure underestimates total turnover since a purchase early in the day which is reversed that same day is not observed.

As reported in Table 5, there are sizable and significant differences in turnover rates among the trader groups. The null that mean turnover rates are the same is rejected at the .001 level. It is also significantly higher for the six speculator groups in general than for potential hedgers in general. At 19.8%, the mean turnover rate is highest for floor traders confirming the commonly held view that these are short-term traders seeking to profit from temporary mispricings and bid-ask spreads. Not surprisingly, turnover rates are also high for three of the four other trader groups which we view as consisting largely of speculators: commodity trading advisors (14.6%), commodity pools (12.1%), and energy traders (13.8%). On the other hand, the "other non-commercial" traders (which consist

primarily of off-floor individuals taking large positions) tend to hold their positions longer; their turnover rate is only 8.2%.

Consistent with our expectations, the mean turnover rate is lowest for end users (4.8%) and fairly high for marketer/distributors (10.5%). However, it was also higher than we expected for refiners (9.4%).

III. Trader Types

The main purpose of this study is to document for the first time how trading practices differ according to the trader's line of business. Having analyzed each of the trading aspects, these results may be rearranged and combined to paint an overall picture of the trading activities engaged in by each of the trader groups. We do so now discussing each in turn.

A. Refiners

Refiners constitute the largest group in terms of number of traders (23% of our sample), total open interest (34%), and trading volume (29%). Confirming the classic refiner hedge example in which a refiner shorts a futures contract in order to lock in a future heating oil sale price, we find that refiners hold almost twice as many short contracts as longs on average. However there is considerable variation; many refiners are net long on occasion and a couple are net long on average. The latter result suggests that either they are occasionally speculating on a price rise or are hedging forward market contracts to sell before they in fact have the crude. We also find that refiners' short contracts tend to be of significantly longer term-to-maturity than their long contract holdings suggesting that their long positions could represent speculations on near-term price changes. Our term-to-maturity and turnover findings indicate that refiners often use the futures market as a <u>temporary</u>, not a permanent, substitute for forward market commitments. For instance, if a refiner contracts at a given price for crude which

she intends to refine and sell in three months and shorts a three-month futures contract to lock in a sale price, she apparently often holds the futures position only until a forward sale contract can be negotiated instead of holding the futures contract until maturity.

B. Marketers/Distributors/Pipelines

This category represents marketers/distributors/pipelines without refining capacity or companies whose marketing and distribution activities are known to substantially exceed their refining activities. Since they supposedly operate on both sides of the forward market - entering both into contracts to buy and contracts to sell heating oil in the future - we expected them to hold spread positions in the futures market and this hypothesis was confirmed. Indeed their spread index is second only to floor traders. However, we also find that, like refiners, their short positions exceed their long positions by almost 2 to 1, implying that they are often contracting to buy fuel oil in the forward market before they have arranged for buyers. Also consistent with this, their short contracts tend to exceed their long contracts in term-to-maturity by over a month, a difference which is significant at the .05 level. With a relatively high turnover rate of 10.5%, it appears that they tend to use the futures market as a temporary hedge until their OTC or forward market positions can be matched.

C. Commercial and Investment Banks

Since many of these banks make markets in energy swaps, we expected that much of their futures market activity would represent hedges of their swap market commitments. However, investment banks are free to also engage in energy price speculation while regulators would tend to minimize this activity for commercial banks. Since banks take positions on both sides of swap transactions, we hypothesized that they, like marketers/distributors, would often hold spread positions. This was confirmed for investment banks but not commercial banks who usually hold either all long or

all short contracts. Our data also revealed that both groups tend to be net long. This is particularly true for commercial banks, which hold roughly three long contracts for every short contract. Investment banks tended to hold the largest positions per trader of all groups. Both bank groups' holdings tended toward moderately long term-to-maturity contracts and their turnover was fairly low.

D. End Users

This small group represents large consumers of fuel oil. As such, we expected them to be net long (buying futures to lock in a future purchase price) and this hypothesis was clearly confirmed. Long positions exceeded short by over 6 to 1. With the lowest turnover rate in our sample, these traders tend to take their long positions and hold them for a long time. In other words, unlike say marketers/distributors they apparently normally use the futures market to construct permanent hedges rather locking-in a purchase price only until they can arrange a purchase in the forward market or a swap.

E. Energy Traders

These are energy firms without any known significant physical energy assets. Many are located off-shore. Given the lack of physical assets, we expect them to be primarily engaged in speculation. Accordingly, we expected them to have high turnover but did not hypothesize whether they would tend to be long or short. They turned out to be net short but not significantly so. In general, they tended to simultaneously hold both long and short contracts suggesting that they were largely speculating on the calendar price relationships. The term-to-maturity of their short holdings was over a month longer than their long holdings, and, as expected, turnover was relatively high.

F. Other Energy Firms

These are energy firms which do not fit into any of the other classifications. Most are exploration/production firms without refining capacity. Since most natural hedges for this group would seem to involve crude oil futures, not heating oil futures, we suspect that most of their trades in the heating oil market are speculative in nature. This group stood out in only one dimension - they had the smallest average open interest position of any of our trader groups. They were about 50/50 short versus long, they were sometime spread and sometimes not, and both the term-to-maturity and turnover rates were close to the overall average.

G. Commodity Pools

These are commodity pools of the sort examined by Elton et. al. (1987), including hedge funds, as identified by the CFTC. Based on anecdotal evidence, we expected these speculators to normally hold long positions and this hypothesis was confirmed. Overall they held 63.4% long contracts to 36.6% short, a difference which was significant at the .01 level. What really stood out about this group however was that they virtually always took pure long or short positions in near-term contracts; they very rarely held calendar spreads. At .097, their spread index was the lowest of the eleven groups and at 44.2 days, their average term-to-maturity was also the lowest of the eleven groups. Turnover was relatively high. These findings are all consistent with the view that commodity pools tend to place large bets on near-term movements in heating oil prices.

H. Commodity Trading Advisors.

These are individuals who advise and trade for others. While often lumped together with commodity pool operators in textbook discussions, the commodity trading advisors turned out to be significantly different in a number of respects. In fact they appear to have much in common with the energy traders group. While commodity pools rarely held calendar spread positions, CTAs often did

and tended to be about 50/50 short versus long. Their turnover was relatively high but term-to-maturity was moderate.

I. Floor Traders

As expected, these traders had the highest turnover rate among the eleven groups. They also had the highest spread index in the sample suggesting that they were primarily trading on the calendar spread relationships and/or hedging their risk by taking spread positions. Interestingly, they also had the longest term-to-maturity of all eleven trader groups: 107.7 days. Since this is the end of the market where open interest and trading volume are low, this evidence indicates that they are providing needed liquidity in the market segment where the need is greatest. This makes sense since the effective bid-ask spreads may be larger in the longer maturities since liquidity is low.

G. Other Non-commercial Traders

This residual category consists largely of off-the-floor individuals who trade futures. Aside from expecting them to be largely engaged in speculation, we had few a priori notions for this group and in general they did not stand out as being unique on any dimension. Their holdings of longs versus shorts was not significantly different from 50/50 and the spread index and term-to-maturity were pretty middle-of-the-road. However at 8.2%, their turnover rate was the lowest of the trader groups which we viewed as largely involved in speculation. Relative to other speculators, they seemed to place a position and maintain it for some time.

IV. Conclusions

For the first time, we are able to document how all large traders in a major futures market operate and how their trading practices differ depending on the trader's line of business. We find substantial and significant differences between the eleven trader types in: their propensity to take long or short positions, whether or not they hold outright or spread positions, the term-to-maturity of the contracts they hold, how long they hold their futures market positions, and the size of their positions. Indeed, the only dimension in which there is not a significant difference is in their tendency to concentrate their holding in the winter contracts; all eleven groups do but there is little difference in their tendency to do so. Clearly, different types of traders tend to come to the market with different objectives based on their cash and forward market positions and this is reflected in their trading practices.

Table 1 - Trader Classifications

Our futures trader classifications and classification procedures are described. We also report the number of traders with an average daily open interest of at least 400 contracts in each category.

Classification	Num.	Description and Classification Procedure
Potential Hedgers:		
Refiners	51	Refiners as identified by the Office of Policy of the Department of Energy.
Marketers/Distributors/ Pipelines	26	Pipeline companies and companies defined by the Energy Department as primarily marketers and distributors. Many of these make markets in swaps and other energy derivatives.
Commercial Banks	15	Two digit SIC code of "60."
Investment Banks and Brokers	17	Two-digit SIC code of "62.".
End Users	6	Non-energy, non-financial companies which are consumers of fuel oil or related products,
Speculators:		
Energy Traders	11	Energy trading companies (mostly offshore) with no known energy assets as identified by the Department of Energy.
Other Energy	12	Energy firms not fitting in the other classifications including firms primarily involved in exploration and production.
Commodity Pools	29	Commodity Pools as identified by the CFTC. Includes hedge funds.
Commodity Trading Advisors	13	A person who advises or trades for others as identified by the CFTC.
Floor Traders	22	Exchange members trading for their own accounts. Includes trades for their own account by floor brokers and futures commission merchants.
Other Noncommercial	21	Non-commercial traders not classified on the CFTC tapes. All (or almost all) are large individual off-the-floor traders.

Table 2 - Market Share by Trader Type

We report two measures of market share: (1) the percentage of the total daily open interest and (2) the percentage of total trade volume in our sample accounted for by the different trader types based on end-of-day open interest positions. Percentages are based on the 223 largest heating oil futures traders over the 6/93-3/97 period. The volume of trading is calculated as changes in end-of-day positions so does not include purely intra-day trades. Also reported is each group's average daily open interest position per trader.

Classification	**Average Daily Open Interest Position (per trader)**	**Measures of Market Share:**	
		Percent of Total Open Interest	**Percent of Daily Trading**
Potential Hedgers:			
Refiners	1781	34.1%	28.8%
Marketers/Distributors	1691	14.6%	20.1%
Commercial Banks	1481	6.9%	2.4%
Investment Banks	3791	26.9%	22.3%
End Users	1121	0.8%	1.4%
Total		**83.3%**	**75.0%**
Speculators:			
Energy Traders	1003	2.6%	3.7%
Other Energy	687	1.5%	1.5%
Commodity Pools	853	4.4%	4.6%
Commodity Trading Advisors	1281	2.6%	6.7%
Floor Traders	738	4.5%	7.5%
Other Noncommercial	811	1.1%	0.9%
Total		**16.6%**	**25.0%**

Table 3 - Long, Short, and Spread Positions of Major Traders

Measures of the degree to which major traders are long or short are presented. Statistics on the percentage of trader classification's total open interest which consists of long contracts is reported in columns 2, 3, and 4. The remaining contracts are short. An asterisk (two) on a t-statistic designates a percentage which is significantly different from 50% at the .05 (.01) level. An asterisk (two) on an F-statistic denotes rejection of the hypothesis that the means are equal for all groups at the .01 (.001) level. In the next three columns, we report the percentage of trading days when the traders hold long contracts only, short contracts only, or both. Finally we report means of a spread index defined as $\frac{\text{total long contracts} - \text{total short contracts}}{\text{Max}(\text{total long contracts}, \text{total short contracts}} \& 1.0$.

	long contracts as percent of total contracts held.			**percent of trading days with positions which are**			**Spread Index (mean)**
Classification	**mean**	**median**	**t-stat (μ=.5)**	**long only**	**short only**	**spreads**	
Potential Hedgers:							
Refiners	35.5%	33.4%	-3.60**	18.2%	44.1%	37.6%	.207
Marketers/Distributors	35.4%	34.1%	-3.45**	8.7%	34.5%	56.8%	.411
Commercial Banks	73.6%	76.5%	3.73**	56.4%	16.7%	27.0%	.140
Investment Banks	62.9%	75.0%	1.63	40.2%	14.0%	45.8%	.259
End Users	86.7%	93.9%	4.86**	70.1%	6.6%	23.3%	.208
Speculators:							
Energy Traders	39.8%	43.0%	-1.39	16.7%	33.0%	50.3%	.348
Other Energy	48.1%	46.1%	-0.25	33.2%	25.2%	41.5%	.297
Commodity Pools	63.4%	60.6%	3.29**	53.0%	35.6%	11.3%	.097
Commodity Trading Advisors	51.2%	52.3%	0.22	35.2%	29.0%	35.7%	.332
Floor Traders	52.1%	49.8%	0.51	28.5%	21.2%	50.3%	.435
Other Noncommercial	59.9%	52.8%	1.30	40.3%	20.5%	39.2%	.301
ANOVA F (H_0: equal means)	6.47**						3.83**

Table 4 - Contract Maturities

We report statistics on terms-to-maturity of the contracts held by each trader group and also the percentage which mature in the winter months: December, January, February. An asterisk (two) on a t-statistic indicates that the null hypothesis that the mean term-to-maturity is the same for long and short contracts is rejected at the .05 (.01) level. An asterisk (two) on an F-statistic denotes rejection of the hypothesis that the means are equal for all groups at the .01 (.001) level.

Trader Type:	Mean Maturity of all contracts in days:	Mean Maturity in days of:		t-statistic: (H_o: $\mu_{long}=\mu_{short}$)	% open interest in winter contracts
		Long Positions	Short Positions		
Potential Hedgers:					
Refiners	70.4	60.2	76.0	-2.57**	41%
Marketers	88.3	66.0	100.6	-2.23*	36%
Commercial banks	89.7	94.2	77.1	-0.87	41%
Investment banks	96.3	95.5	97.6	-0.13	42%
End Users	63.1	64.0	57.0	0.15	40%
Speculators:					
Energy traders	64.8	46.0	77.1	-4.94**	45%
Other energy	74.5	79.3	70.1	0.73	49%
Commodity pools	44.2	43.2	45.9	-0.39	38%
CTAs	83.7	73.7	94.1	-1.37	38%
Floor traders	107.7	109.3	106.1	0.61	28%
Other N.C.	67.0	56.5	82.6	-1.58	50%
ANOVA F (H_o:equal means)	3.86**	4.65**	2.04		1.40

Table 5 - Portfolio Turnover Rates	
Statistics on the daily turnover rate defined as the average absolute daily change in the open interest position divided by the average daily open interest are presented. The two asterisks on the F-statistic denotes rejection of the hypothesis that the mean turnover rates are equal for all groups at the .001 level.	
Classification	**Mean Daily Turnover Rate**
Potential Hedgers:	
Refiners	9.41%
Marketers/Distributors	10.51%
Commercial Banks	6.19%
Investment Banks	6.79%
End Users	4.80%
Speculators:	
Energy Traders	13.82%
Other Energy	9.59%
Commodity Pools	12.14%
Commodity Trading Advisors	14.64%
Floor Traders	19.81%
Other Noncommercial	8.15%
ANOVA F (H_o:equal means)	4.25**

REFERENCES

Bessembinder, Hendrik. 1992. Systematic risk, hedging pressure, and risk premiums in futures markets, *Review of Financial Studies* 5 (4): 637-667.

Bodnar, Gordon M., Gregory S. Hayt, Richard C. Marston and Charles W. Smithson. 1995. How corporations use derivatives, *Financial Management* 24 (2): 104-114.

Bodnar, Gordon M., Gregory S. Hayt and Richard C. Marston. 1996. 1995 Wharton survey of derivatives usage by US non-financial firms, *Financial Management* 25 (4): 113-133.

Chang, Eric, Ray Chou, and Edward Nelling. 2000. Market volatility and the demand for hedging in stock index futures, *Journal of Futures Markets* 20 (2): 105-125.

Culp, Christopher and Merton Miller. 1995. Metallgesellschaft and the economics of synthetic storage, *Journal of Applied Corporate Finance* 7 (4): 62-76.

deRoon, Frans, Theo Nijman, and Chris Veld. 2000. Hedging pressure effects in futures markets, *Journal of Finance* 55 (3): 1437-1456.

DiMartino, Dawn, Linda Ward, Janet Stevens and Winn Sargisson. 1996. Proctor & Gamble's derivatives loss: isolated incident or wake-up call?, *Derivatives Quarterly* 2 (3): 10-21

Edwards, Franklin and Michael Canter. 1995. The collapse of Metallgesellschaft: unhedgeable risks, poor hedging strategy, or just bad luck, *Journal of Futures Markets* 15 (3): 211-264.

Elton, Edwin, Martin Gruber, and Joel Rentzler. 1987. Professionally managed, publically traded commodity funds, *Journal of Business* 60 (2): 175-199.

Hartzmark, Michael. 1987. Returns to individual traders of futures: aggregate results, *Journal of Political Economy* 95 (6): 1292-1306.

Hartzmark, Michael. 1991. Luck versus ability: determinants of trader performance in futures markets, *Journal of Business* 64 (1): 49-74.

Haushalter, G. David. 2000. Financing policy, basis risk, and corporate hedging: evidence from oil and gas producers, *Journal of Finance* 55 (1): 107-152.

Hirschfeld, David. 1983. A fundamental overview of the energy futures market, *Journal of Futures Markets* 3 (1): 75-100.

Leuthold, Raymond M., Philip Garcia and Richard Lu. 1994. The returns and forecasting ability of large traders in the frozen pork bellies futures market, *Journal of Business* 67 (3): 459-473.

Ma, Cindy. 1989. Forecasting efficiency of energy futures prices, *Journal of Futures Markets* 9 (5): 393-419.

Manaster, Steven and Steven C. Mann. 1996. Life in the pits: competitive market making and inventory control, *Review of Financial Studies* 9 (3): 953-975.

Silber, William. 1984. Marketmaker behavior in an auction market: an analysis of scalpers in futures markets, *Journal of Futures Markets* 39 (4): 937-953.

ENDNOTES

1. Case studies of individual traders include Culp and Miller (1995), Edwards and Canter (1995), and DiMartino et al (1996). The activities of particular types of traders are examined by Silber (1984), Elton, Gruber, and Rentzler (1987), and Manaster and Mann (1996). For surveys of derivatives use by corporations, see Bodnar et al (1995), Bodnar et al (1996), and for energy firms in particular, Haushalter (2000)..

2. For a good overview of this and other energy markets, see Hirschfeld (1983).

3. In addition to requiring holders of more than 250 heating oil contracts to report, those with large positions in other related markets are required to report their heating oil positions even if less than 250. Particularly once we restrict our data set to those whose open interest position averaged at least 400 contracts, we generally observe a continuous series for each trader.

4. This 400 contract cutoff was based only on days when the trader's open interest position was not zero. In other words, if a trader held an open interest position of 500 contracts for only ten days in our data period and was out of the market on all other days, that trader would be included in our data set.

5. Examples include Hartzmark (1987, 1991), Bessembinder (1992), Leuthold et al (1994), deRoon et al (2000), and Chang et al (2000).

6. In our data set, the traders are identified by an identification number and we do not know which company belongs to which number. The classifications were carried out in a manner which preserved this anonymity. As explained below, we used the CFTC codes for "non-commercial" traders. For the "commercial" traders, we supplied the Office of Policy at the Energy Department with a list of the identification numbers in our final data set. They sent back a list of the firm names with no identification numbers attached. With the assistance of the Office of Policy, we classified the firms and assigned each a classification code. The Office of Policy then assigned the agreed classification code to each trader identification number.

7. Since firms may serve in more than one of these capacities, the CFTC often assigns more than one classification code. For instance, a commodity pool operator may delegate its trading to a commodity trading advisor so many of the commodity pools carry the CTA code as well as the CPO code. We base our classifications on the first or primary code.

8. In some cases, a firm might be both a refiner and a marketer/distributor. Or, a firm might engage in both energy trading and marketing. In these we relied on the judgment of the officials at the Department of Energy as to the firm's primary activity.

9. This group and the "other non-commercial" are similar with the distinction being that the "energy traders" are companies while the "other non-commercial" traders are individuals.

10. The status of one member of this group was uncertain.

11. The crude oil futures market is also more heavily traded that heating oil so should be more liquid.

12. They are also conditional on the trader being in the market. In other words, while we observe 51 refiners, all 51 are not in the market over our entire data period. Hence this figure represents the average daily open interest when the open interest is not zero.

13. Traders are not simultaneously both long and short the same contract but are often long one contract, for example the June contract, and simultaneously short another contract, e.g., July.

14. Among the studies examining this issue are Bessembinder (1992) and deRoon et al (2000).

15. We use the futures price right before expiration, $F_{T,T}$, instead of the available spot price, series, S_T, because the futures contract contains two delivery options which could cause the fuel oil being delivered on the futures contract to differ from that represented by the available spot price series. The short making delivery can choose exactly which grade of fuel oil to deliver. On the other hand, the long can (within prescribed limits) specify the delivery days. However, it turns out that there is no significant difference between $F_{T,T}$ and S_T, and our results are roughly the same if we use S_T.

16. However, open interest declines sharply in the few days before the nearby futures contract matures.