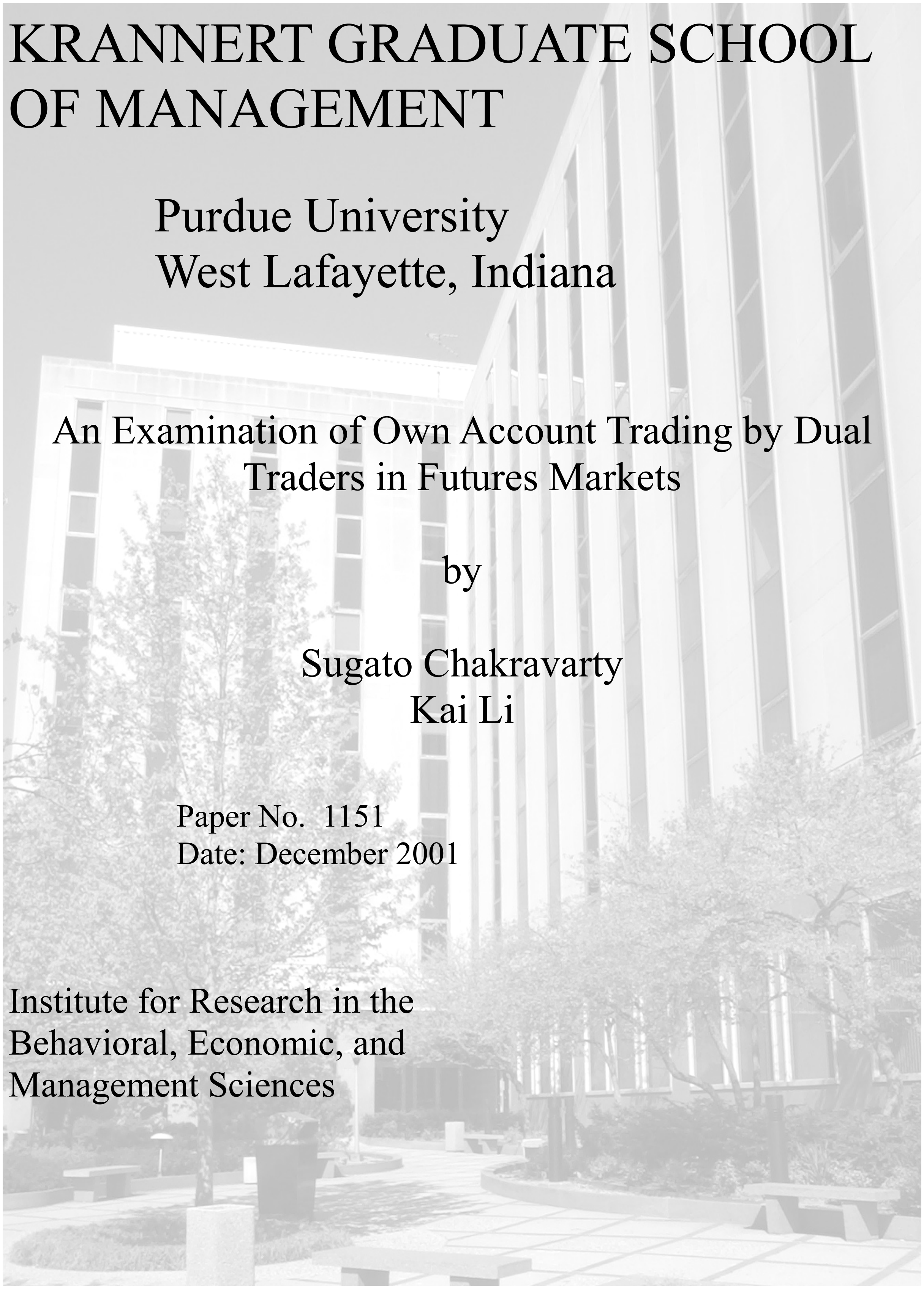

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An Examination of Own Account Trading by Dual Traders in Futures Markets

by

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Abstract

Using proprietary audit trail transactions compiled by the Commodity Futures Trading Commission, we investigate, at the individual trader level, (1) the *timing* and (2) the *determinants* of dual traders' personal trades. Our analysis reveals a surprising absence of any trade timing by dual traders in relation to the execution of their customers' orders. Further examination employing correlation statistics and time series regressions provides strong support for dual traders as liquidity suppliers and for their inventory control behavior. Finally, after simultaneously controlling for factors representing information, liquidity supply and inventory control, within a multivariate regression framework, the determinants of a dual trader's personal trading decision appear to be liquidity supply and inventory control. Overall, the emergent profile of a dual trader is that of an uninformed trader performing complimentary tasks of liquidity provision and personal inventory control. These results survive extensive robustness checks, question the assumptions underpinning the extant theoretical research and have important policy implications.

Keywords: dual trading, front running, informed trader, inventory, liquidity
JEL Classification: G20, G28

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Abstract

Using proprietary audit trail transactions compiled by the Commodity Futures Trading Commission, we investigate, at the individual trader level, (1) the *timing* and (2) the *determinants* of dual traders' personal trades. Our analysis reveals a surprising absence of any trade timing by dual traders in relation to the execution of their customers' orders. Further examination employing correlation statistics and time series regressions provides strong support for dual traders as liquidity suppliers and for their inventory control behavior. Finally, after simultaneously controlling for factors representing information, liquidity supply and inventory control, within a multivariate regression framework, the determinants of a dual trader's personal trading decision appear to be liquidity supply and inventory control. Overall, the emergent profile of a dual trader is that of an uninformed trader performing complimentary tasks of liquidity provision and personal inventory control. These results survive extensive robustness checks, question the assumptions underpinning the extant theoretical research and have important policy implications.

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1. Introduction

Dual trading is an age-old custom in futures markets whereby some floor traders are allowed to trade both for themselves and for their customers.[1] This seemingly innocuous practice has attracted the attention of researchers and regulators alike, in light of ongoing Congressional debate on imposing personal trading restrictions on dual traders. An excerpt from Bloomberg news wire release, July 22, 1999, titled "Regulators to Decide Personal Trading by Futures Brokers" reads, in part, as follows:

> *U.S. regulators are gearing up to decide soon whether to limit a common trading practice on futures exchanges in Chicago that some critics say raises the potential for brokers to cheat their customers. ......(If these trading limits are imposed) "We will lose some of our brokers, who say they need to supplement their income by trading for themselves as well as their customers," said Jim Sutter, who manages Cargill Inc.'s oilseeds and grain futures trading on the exchange.*

The supporters of the ban on dual trading argue that these floor traders are in a position to front run on their customers' orders. An FBI sting in 1989 found that brokers (including dual traders) were cheating customers, leading to dozens of arrests and a 1992 government ban on dual trading in major futures contracts. Interestingly, Congress banned the practice of dual trading but then left the door partially open by telling regulators they could decide on when to enforce it. Opponents of the ban claim (see Grossman (1989)) that some of the brokers affected by the ban might exit the market, resulting in illiquid markets and higher trading costs for investors.

We contribute to this debate—which ultimately boils down to whether dual traders should be allowed to enjoy the privilege of own account trading along with their normal brokering activities—by investigating two related questions not addressed by the extant empirical literature. Specifically, we examine (1) the *timing* of a dual trader's personal trades, in relation to the execution of her customers' orders; and (2) the *determinants* of her personal trading decision. Existing research suggests the possible candidates, driving dual traders' personal trading, are information, liquidity supply, and/or inventory control.[2]

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[1] The Chicago Mercantile Exchange (CME) Rulebook defines dual trading as: *The term "dual trading" shall mean trading or placing an order for one's own account, an account in which one has a direct or indirect financial interest or an account which one controls, in any contract month in which such person previously executed, received or processed a customer order on the Exchange floor during the same Regular Trading Hours session.*

Trade-timing issues have not been addressed in the dual trading literature, possibly due to the paucity of appropriate data, while an analysis of the determinants of a dual trader's personal trading decision, within a multivariate regression framework, is also absent. The focus, in contrast, has largely been to examine the correlation between trade-related characteristics and each of the above-mentioned factors, in isolation of the others, for a cross-section of dual traders.

The CME definition of dual trading (see footnote 1), coupled with the results of existing research, provide us with testable implications related to information, liquidity supply and inventory control in terms of the timing/direction of dual traders' personal trades vis-à-vis the execution of their customers' orders. Thus, for example, under the information scenario, dual traders could become informed after observing their clients' orders and/or by knowing something about the identities of the customers including motivations for their trades. They could then take advantage of this information by trading on their own account—either ahead of or following the execution of their customers' orders. Thus, a simple test of dual traders' informativeness is to examine the existence (and direction) of causality between a dual trader's personal trades and her clients' trades. Similarly, a test of the liquidity-supplying role of dual traders is to investigate whether their own account trades are always in the opposite direction to accommodate the liquidity demand by the rest of the market. Finally, a test of the inventory-rebalancing hypothesis is to examine if dual traders' own account trading makes their inventory revert rapidly to a desired level (i.e., mean-reverting).

Our data are time series of audit trails compiled by the Commodity Futures Trading Commission (CFTC) providing information on trade time, price, quantity, trade direction (buyer or seller) and the trader's identification. They are used internally by the CFTC for regulation and/or enforcement purposes.

On performing tests of causality (in the Granger (1980) sense), on a trader-by-trader basis, we find an absence of dual traders' personal volume either (Granger) causing their customers' volume or vice versa. This result survives a battery of robustness checks performed on various partitions of the data. We also test for, and reject, the possibility of inter-dealer collusion in such matters.

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[2] See, for example, Grossman (1989), Roell (1990), Fishman and Longstaff (1992), Smith and Whaley (1994), Chakravarty (1994), Chang, Locke and Mann (1994), Sarkar (1995), Chang and Locke (1996), Manaster and Mann (1996), and Locke, Sarkar and Wu (1999).

In the spirit of the CFTC's original inquiry into the fraudulent practices on the CME in 1989, we investigate the *direction* of a dual trader's personal trades in relation to her customers' trades and find that there is significant negative correlation between dual traders' own account trades and the liquidity demand by the rest of the market. Thus, dual traders appear to be liquidity suppliers. Our tests further reveal that dual traders are significant liquidity providers during times of large price swings and when other liquidity suppliers (such as locals) are in short supply. They may also have a more important liquidity-providing role in relatively lower volume futures pits. Additionally, we find strong evidence of rapid mean reversion in the personal inventory of individual dual traders in our sample.

Finally, we examine the determinants of a dual trader's decision to trade for her own account, after simultaneously controlling for information, liquidity supply and inventory control behavior, as well as other factors considered relevant by the extant literature. We find that a dual trader's decision to trade for her own account is determined mainly by liquidity supply and inventory control reasons. The result that dual traders both provide liquidity and control personal inventory is, in essence, opposite sides of the same coin—one requiring a dual trader to move away from her desired inventory position (through liquidity supply), the other fueling the need to revert back toward her desired inventory position (through inventory control).[3] Our results call into question the notion that dual traders are informed traders capable of misusing their information for private gain. This may assuage the concerns of regulators when determining the prevalence and/or the seriousness of such offenses.

The remainder of the paper is organized as follows. Section 2 reviews the related literature while Section 3 discusses the data. Section 4 examines the direction of causality between dual traders' personal trades and their customer trades, using a trader-by-trader approach. Section 5 examines the liquidity-providing role of dual traders, while Section 6 investigates dual traders' inventory management practice. Section 7 examines the determinants of dual traders' personal trades under a multivariate regression framework. Section 8 concludes. An appendix detailing the dual traders used in the analyses is omitted for brevity, but is available on request.

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[3] We thank an anonymous referee for providing this intuition.

2. Related Literature

The theoretical literature on dual trading starts with the basic assumption that dual traders are informed traders and then investigates the effects of their trading strategies (through piggybacking and/or front running) on market liquidity and informativeness of prices (see, for example, Grossman (1989), Roell (1990), Fishman and Longstaff (1992), Chakravarty (1994), and Sarkar (1995)). While providing numerous valuable insights, this literature is unable to provide any guidance on the fundamental question of whether dual traders are informed traders to begin with—a primary focus of the current research.

The empirical literature on dual trading can be classified into two main themes. The first theme focuses on the liquidity effects of various dual-trading restrictions imposed on the futures markets.[4] For example, Smith and Whaley (1994) find that the effective bid-ask spread increases and trading volume decreases as a result of restrictions on dual trading in the S&P 500 futures contract. Chang, Locke and Mann (1994) examine changes in the trading behavior of the CME floor traders since the implementation of the Rule 552, and conclude that dual traders possess valuable skill and information related to the particular commodity they are trading. Chang and Locke (1996) analyze dual trading on futures contracts restricted by the CME Rule 552 and report that dual traders are superior brokers and find no evidence of informational advantage in dual traders' personal trading. Locke, Sarkar and Wu (1999) examine whether aggregate liquidity measures are appropriate indicators of trader welfare in markets with multiple dealers possessing heterogeneous skills. They find that dual trading restrictions, while hurting skilled dual traders and their customers, have little impact on market depth.

The second theme of the empirical literature examines a cornucopia of issues related to the microstructure of futures markets. Manaster and Mann (1996), for example, use futures transaction data to investigate cross-sectional relationships between market maker inventory positions and their trading activity. The authors find that competitive market makers at the CME appear to actively manage their inventory and learn from customer trades and conjecture that there are heterogeneous information advantages possessed by market makers. Ferguson and Mann (2001) examine customer transaction costs at the CME and report that the bid-ask spreads are U-shaped over the trading day. Finally Locke and Mann (1999) explore behavioral explanations of own account trading by dual traders.

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[4] Examples of such restrictions include the "top-step rule" implemented by the CME on the S&P 500 futures contract in June 1987, and the imposition of CME Rule 552 on all high volume futures contracts effective May 1991.

In sum, the extant empirical literature too is unable to answer our central question: what are the *ex ante* determinants of personal trading by dual traders? Whether it is information, liquidity provision, or inventory control that drives the personal trading decision of dual traders is ultimately an empirical question and should be analyzed within a unified framework. This paper provides just such an analysis in an effort to reconcile the different lines of research on dual trading. Additionally, almost all existing empirical studies perform cross-sectional analyses across dual traders.[5] In contrast, the questions we address necessitate a trader-by-trader analysis. Finally, most empirical studies cited above examine the merits (and pitfalls) of dual trading using futures contracts subject to various dual-trading restrictions. We, however, examine only those futures contracts that permit unrestricted dual trading. Given that the current policy debate centers on whether a ban on dual trading would reduce market liquidity, our approach easily complements existing studies.

3. Data

3.1. *Contract selection and data characteristics*

Our data consist of audit trail transaction records of eight futures contracts traded on the CME during the first six months of 1992. The contracts are live cattle, hogs, pork bellies, feeder cattle, lumber, Canadian Dollar, T-bill, and S&P 400. The two million plus transaction records provide a detailed look at the complete trading history of all floor traders in these eight futures pits. We supplement the above data with the daily settlement price data to calculate trading profits (defined later).

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[5] Locke, Sarkar and Wu (1999), in fact, suggest that traders could be heterogeneous with respect to trading skills, and that aggregate measures of trading costs, such as average bid-ask spreads, could be misleading. Consistent with the above, they develop a theoretical model based on dealer heterogeneity. Curiously, however, their empirics are then based on analyses of pooled trader groups (i.e., they perform cross-sectional analyses). Fishman and Longstaff (1992) is the only known exception that briefly examines the trading histories of the most/least profitable traders in their sample.

The reason for restricting our attention to these eight futures contracts is that, since May 1991, the CME Rule 552 explicitly prohibits dual trading activities on the most active contracts on the exchange. According to Chang, Locke and Mann (1994), all the major currency contracts are affected by the rule. Given that our goal is to study a dual trader's own account trading, we examine only contracts that allow *unrestricted* dual trading.

The audit trail data record each transaction twice, once for each party to a trade. An exchange algorithm, called the computerized trade reconstruction, uses each trader's independently reported sequence of trades, in conjunction with the time and sales data, to time each trade within a minute. Since some timing errors are likely, we perform our analysis in 5-minute time intervals. For robustness, we also replicate all subsequent analyses with various time intervals, greater or less than five minutes, and obtain similar results.

In addition to trade time, the audit trail records provide price, quantity, specifics of the contract, and the trader's identification.[6] Unique to this data, each record also specifies the trade direction and a classification of the customer types on each side of a trade. There are four customer type indicators (CTI), labeled 1 through 4. The CTI 1 trades are market making trades for personal account (39% of the volume); CTI 2 trades are trades executed for the account of the trader's clearing member (6.2% of the volume); CTI 3 trades are trades executed for the account of any other exchange member (5.7% of the volume); and CTI 4 trades are the trades of outside customers (49.1% of the volume). These numbers are consistent with the statistics reported in Chang and Locke (1996), and Manaster and Mann (1996). Following Fishman and Longstaff (1992), Chang, Locke and Mann (1994), and Locke, Sarkar and Wu (1999), we focus our attention mainly on CTI 1 trades (market-makers' trades for their personal account) and CTI 4 trades (trades for outside customers). We only briefly examine CTI 3 trades in Section 4.5, as a robustness check of one of our results.

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[6] To protect trader privacy, however, the CFTC maps each trader's exchange badge number to a randomly selected number unique to the trader.

While we report results based on transactions in contracts of *all* maturities, we also replicate our analyses with transactions in the nearest maturity contracts only, at any point in time, and find that our results remain virtually unchanged.

3.2. *Trader classification*

Our definitions of a dual trading day and dual traders follow Locke, Sarkar and Wu (1999). We calculate a trading ratio d as the proportion of a floor trader's personal trading (CTI 1) volume over her total trading volume for the day she is active. For each floor trader, a trading day is a local day if $d > 0.98$, a broker day if $d < 0.02$, and a dual trading day if d lies on the closed interval [0.02, 0.98]. When a broker makes a mistake in executing a customer order, the trade is placed into an error account as a trade for the corresponding broker's personal account. Thus, the 2% filter is used to allow for the possibility of error trading and appears reasonable based on communications with the CFTC. As a robustness check, we also replicate all subsequent analyses, successively, with 0%, 5%, and 10% filter rules.[7] Upon re-estimation, our results remain qualitatively similar in each case.

A floor trader with at least one dual trading day in the sample is defined as a dual-trader. The criterion for a specific floor trader to be included in our sample as an active dual trader is that the number of her dual trading days exceeds 50, out of a maximum of 126 trading days during the first six months of 1992. With this filter, we obtain a total of 101 active dual traders in our sample across the eight futures contracts. Of these, the live cattle contract has the largest number (40) of active dual traders, while the S&P 400 contract has only one active dual trader. These 101 traders account for well over half the total volume in our original data. The remaining dual traders trade only sporadically and, hence, do not provide us with enough observations to conduct tests with any degree of power. Also, given the sporadic nature of their trades, it is questionable if they can tell any story whatsoever. Thus, these dual traders and their trades are excluded from the sample. To ensure that the peculiarities of our sample selection do not drive the results, and the conclusions reached from analyzing the 101 dual traders are representative of the market as a whole, we also experiment with varying cutoff values below 50 dual trading days, to include progressively more dual traders in our sample. Upon re-estimation of our model in each case, the results remain similar and our conclusions unchanged.

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[7] That is, for each floor trader, a trading day is a broker trading day if the fraction of personal trading volume is $d = 0$ ($d < 0.05, 0.10$ using the 5%, 10% filters, respectively), and a dual trading day if d lies in the interval (0, 1) (in the closed intervals [0.05, 0.95], [0.10, 0.90] using the 5%, 10% filters, respectively).

We perform a robustness check to ensure that our sample of dual traders behaves distinctly on their dual trading days from two other important classes of futures floor traders: locals[8] and brokers. The former trade solely for their personal accounts while the latter never trade on their personal account. We obtain fractions of *market volume* contributed by these different types of traders. Thus, in every 5-minute time interval of a particular trading day, we aggregate the volume of traders who are making market on that day as *local volume;* the volume of traders who are brokering on that day as *broker volume;* and the volume of traders who are dual trading on that day separately into *dual trader personal volume* and *dual trader customer volume.*[9] Next, we compute the fraction of *market volume* contributed by locals, brokers and dual traders. We find that, in aggregate, dual traders appear to play a less significant role as liquidity suppliers than locals. For example, the mean faction of *dual trader personal volume* ranges from 0.0500 for S&P 400 to 0.1781 for T-bill futures, while the mean fraction of *local volume* ranges from 0.2566 for Canadian dollars to 0.4077 for lumber. Thus, except for Canadian dollars, the fraction of *market volume* contributed by dual traders is less than half that contributed by locals. Dual traders, however, appear to execute more customer volume (as brokers) than pure brokers in all contracts except for feeder cattle and S&P 400 futures. The mean fraction of *dual trader customer volume* ranges from 0.1528 for S&P 400 to 0.4713 for Canadian dollars, while the mean fraction of *broker volume* ranges from 0.0654 for lumber to 0.4759 for S&P 400 futures. In sum, dual traders, on their dual trading days, appear to behave very distinctly from their days of acting as pure locals or as pure brokers.

4. Dual Trading and Information

The CME trading rules define piggybacking and front running in terms of the *timing* of a dual trader's personal trades relative to her customer trades (see footnote 1). This is because one way for dual traders to become informed is by observing their customers' orders and from knowing something about their customers' trading motivations. The dual traders could then conceivably take advantage of this information by either trading ahead of or trading after executing their customers' orders. It, therefore, follows that any evidence of causality between a dual trader's personal trades and her customer trades is consistent with evidence that dual traders may become informed through observing their customers' orders. To see if such causality exists, we set up simple tests following Granger (1980). The specific empirical models used are discussed below.

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[8] Locals supply liquidity and rarely hold open positions overnight. Their liquidity-providing role also earns them the title of market makers.

[9] The classification of futures traders into dual traders, locals, and brokers is based on traders' trading practice on a particular trading day. Hence, these traders could change their roles from day to day.

4.1. *Tests of piggybacking/front running using the individual trader-based approach*

A central assumption in Fishman and Longstaff's (1992) model is that dual traders have an informational advantage over other floor traders (like locals). If these dual traders take advantage of their information by trading for their own account, then a) trading profits of dual traders should be greater than those of non-dual traders, and b) customers of dual-trading brokers should do better than customers of non-dual-trading brokers. Fishman and Longstaff compute expected trading profits based on the cross section of all traders in their sample and report that dual traders, overall, earn greater trading profits than non-dual traders, thereby supporting their initial conjecture that dual traders are informed traders.

We, however, argue that a similar aggregated analysis using trading volume measures might lead to misleading conclusions due to spurious correlations. Consider, for example, a dual trader *A* purchasing a futures contract on her own account at time t. Two other dual traders, *B* and *C*, totally unrelated to *A*, purchase the same contract for their customers in the following period. A test using aggregated trading volume measures would then indicate strong positive correlation between dual traders' personal trades in time period t and their customer trades in time period t+1. A possible implication of such a finding could be that front running exists in the contract when, in fact, there is none. It is, therefore, appropriate to conduct an individual trader-based analysis.

Accordingly, we define *DT personal netbuy* as the difference between a dual trader's buy volume and her sale volume on personal account in time interval t, and *DT customer netbuy* as the difference between a dual trader's customer buy volume and her customer sell volume in time interval t. The null hypothesis to examine if a dual trader's personal trades *follow* her customer trades involves running the following Granger-type regression for each dual trader in our sample:

$$DT\ Personal\ Netbuy_t = a_0 + a_1 DT\ Customer\ Netbuy_{t-1} + \ldots + a_J DT\ Customer\ Netbuy_{t-J}$$
$$+ b_1 DT\ Personal\ Netbuy_{t-1} + \ldots + b_J DT\ Personal\ Netbuy_{t-J} + u_t, \quad (1)$$

and testing $a_1 = \ldots = a_J = 0$.

Contrarily, the null hypothesis to examine if a dual trader's personal trades *precede* her customer trades involves running the following Granger-type regression for each dual trader in our sample:

$$DT\ Customer\ Netbuy_t = a_0 + a_1 DT\ Customer\ Netbuy_{t-1} + \ldots + a_J DT\ Customer\ Netbuy_{t-J}$$
$$+ b_1 DT\ Personal\ Netbuy_{t-1} + \ldots + b_J DT\ Personal\ Netbuy_{t-J} + v_t, \quad (2)$$

and testing $b_1 = \ldots = b_J = 0$.[10]

Since equations (1)-(2) are time series regressions, we estimate them using the asymptotically robust Generalized Method of Moments (GMM), proposed by Hansen (1982) in order to minimize autocorrelation and heteroscadasticity related problems in the error terms. Fortunately, GMM requires very weak assumptions on the error terms—only that they have well defined unconditional moments, including when the moments are conditionally varying. To implement the Granger tests, we use the Wald Chi-squared test statistic with degrees of freedom equal to the number of lags J. For robustness, the causality tests are conducted with J = 1, 3, and 5.

Since we have 101 sets of regression estimates for each regression specification, we report the results in the following way. Table 1 Panel A reports the Granger causality test results by providing the number of dual traders in each contract for whom the null hypothesis of no piggybacking is rejected at the 5% significance level (or better). Across all contracts, we find that only about a tenth of the dual traders in our sample trade personally immediately following execution of their customers' trades. In Panel B, there is weak evidence of dual traders trading personally ahead of their customers' orders. Less than a tenth of the dual traders' personal trades precede their customers' trades in any economically significant way.

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[10] Note that our empirical setup implicitly assumes that dual traders are myopic. This may seem contradictory to Kyle (1985), where the *single* informed trader is assumed to have long-lived private information. However, in an extension of the basic Kyle framework, Holden and Subrahmanyam (1992) argue that Kyle's assumption of a single informed trader is too strong and show that in a world of *multiple* informed traders, competition causes most of the informed traders' common private information to be revealed immediately. This argues for informed traders with short-lived private information as we have assumed in our empirical setting. Additionally, Ito, Lyons and Melvin (1998), and Locke and Mann (1999) find that the information sources associated with floor trader profitability are undoubtedly order-flow related, and, thus, of short duration.

In summary, by equating a dual trader's propensity to trade personally after her customers to piggybacking and her propensity to trade personally ahead of her customers' orders to front running, a trader-by-trader analysis indicates that neither piggybacking nor front running may be an economically significant phenomenon.

4.2. *Tests of piggybacking/front running on profitable customer trades*

An underlying assumption of the Granger tests performed above is that all customer trades have equal information content—or that all customer trades are equally beneficial to piggyback or front run on. But we know that customer trades come in many flavors. Some are passive orders triggered by price movements while others are high priority market orders that need to be worked on the floor of the exchange. It is, therefore, reasonable to expect that the latter may contain more information than the former and may result in more frequent piggybacking/front running. To the extent that the more informative customer trades also lead to greater profits for the customer, we identify dual traders' customer trades, based on ex-post profitability, and examine whether piggybacking/front running is associated with the profitability of trades being followed or fronted.

Following Fishman and Longstaff (1992) we compute the ex-post trading profit of a dual trader's customers in time interval *t* on day *d* as

$$\pi_{t,d} = \textit{Buy Volume}_{t,d} \times (\textit{Settlement Price}_d - \textit{Purchase Price}_{t,d}) \\ + \textit{Sell Volume}_{t,d} \times (\textit{Sale Price}_{t,d} - \textit{Settlement Price}_d). \qquad (3)$$

Thus, a profitable buy trade (sell trade) is made when the purchase (sell) price is below (above) the day's settlement price. We now retain only those observations of *DT customer netbuy* when a dual trader's customers profit in time interval t. We use this subset of observations to carry out tests on piggybacking/front running.[11] For brevity we do not formally present these results or those corresponding to subsequent robustness checks. All results are, however, available on request.

We find that a very small number of dual traders trade personally immediately following or immediately preceding execution of their customers' trades. For example, employing the 1-lag (3- and 5-lags) Granger regression, in the live cattle contract, only 2 (2 and 3, respectively) dual traders are found to be piggybacking; in the feeder cattle contract, none (1 and 1, respectively) of the dual traders appears to be front running. We go a step further and retain only those observations of *DT customer netbuy* where a dual trader's customers make above average profits for that day. Again we find little evidence of dual traders either piggybacking or front running. In sum, our earlier conclusions appear robust. We do not find dual traders behaving differentially to profitable customer trades relative to all customer trades.

4.3. *Tests of piggybacking/front running on "skilled" customer trades*

It is also possible that some of dual traders' customers are more skilled at trading than others and a dual trader may follow or front run on those trades rather than all of her customer trades. To see if this is indeed the case, we classify dual traders' customer trades using the "execution skill" measure introduced by Manaster and Mann (1996).

Specifically, we compute the skill of a dual trader's customer trades as the difference between the volume-weighted mean sell price (or buy price) of a dual trader's customers (CTI 4 trades), and the volume-weighted mean sell price (or buy price) of all trades, during each 5-minute interval. Thus, for all customer purchases within time interval t, execution skill is positive (negative) when a dual trader's customers execute at a price lower (higher) than the average purchase price for all trades in that time interval. Likewise, for all customer sales, execution skill is positive (negative) when a dual trader's customers sell at a price higher (lower) than the average sale price for all trades in that time interval. When a dual trader's customers have both buy and sell transactions in time interval t, skill is computed as a volume-weighted measure of buy-price and sell-price skills.

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[11] Note that through the current and subsequent refinements, the number of dual traders examined in each contract does not change. The only difference is the (reduction in the) number of time series observations for each dual trader.

We retain only those observations of *DT customer netbuy* where a dual trader's customers exhibit positive trading skills, that is, they buy at below average market price and sell at above average market price. We use this subset of observations to carry out Granger causality tests on piggybacking/front running. We find that only a few dual traders either piggyback or front run on their customers' orders. Overall, we find no relationship between skilled customer trades and a dual trader's personal trades. Upon retaining only those observations of *DT customer netbuy* where a dual trader's customers have above average execution skills, the results remain virtually identical to those discussed above.

Finally, Manaster and Mann (1996) show that futures floor traders usually maintain a zero inventory position at the end of the trading day. Hence, sales on personal account (i.e., inventory reducing behavior) by futures floor traders might be related to inventory control effects, discussed later in the paper. By the same token, however, inventory-increasing trades, that take these traders away from their preferred position, might be information driven. We, therefore, investigate piggybacking/front running using dual traders' inventory-increasing trades only and find there are even fewer dual traders using their buy trades to piggyback or front run. Overall, we do not find any evidence to suggest that the inventory-increasing trades of dual traders are motivated by either piggybacking or front running, i.e., information driven.

4.4. *Dual trader profitability*

We delve deeper in our attempt to detect significant piggybacking/front running in our sample of dual traders by comparing the trading profits of those dual traders identified, in Table 1 (the baseline case), to be either piggybacking or front running on their customers' orders, to the trading profits of those dual traders who do neither. If there were significant correlation between dual traders who either piggyback or front run and dual traders who make the highest profits, we would have uncovered circumstantial evidence linking dual traders to informed trading.

While there appears to be some weak support for the notion that dual traders who indulge in either activity also end up making higher profits, the evidence is far from (statistically or economically) significant. In the live cattle and pork bellies contracts, for example, we find no statistically significant difference in the average (as well as median) profit between dual traders who piggyback or front run to those who do not indulge in either activity.

In the live hogs contract, out of 15 eligible dual traders, only 2 (1) dual trader(s) appear to be piggybacking (front running) her customers and making significantly more profits than those 13 (14) who do not piggyback (front run). Once again, our original message appears to hold: there is no evidence to suggest dual traders piggyback or front run in any economically significant way.

4.5. *Trading through collusion*

Even though we have shown that own account trading by dual traders, either ahead of or following the execution of their customer orders, is not prevalent at an individual trader level, it is possible that some of these floor traders could act collusively to execute trades on others' behalf. Thus, for example, one trader may trade on behalf of her friend who has the (illegal) information. Any reasonable test of causality between a trader's personal trades and those of her clients has to account for such a possibility. Fortunately, our data allow us to identify a floor trader's trades executed on behalf of other traders (CTI 3 trades). The data do not, however, provide us with details about which particular trader a CTI 3 trade is executed for. Consequently, we aggregate all CTI 3 (exchange member-for-member) trades in every 5-minute interval, and examine causality between the aggregated CTI 3 net buy trades and *DT customer netbuy* on a trader-by-trader basis. Notice that by linking individual trader-specific customer trades with aggregated (by necessity) member-for-member trades, we actually skew the tests toward finding collusive trading practices.[12] We still do not find any significant correlation between the aggregated CTI 3 trades and either lead or lagged *DT customer netbuy.* Moreover, an inspection of the total CTI 3 volume on a contract-by-contract basis reveals that it averages about 5% of the total volume (and of the total transaction frequency). Thus, the evidence does not indicate any presence of broker complicity to execute personal trades on each other's behalf. Furthermore, the magnitude of all CTI 3 trades themselves shows that any trade through broker complicity, not picked up by our tests, is unlikely to be economically significant.

In summary, there is little evidence to suggest that dual traders either trade ahead of or trade following execution of their customer's orders—either on their own or through other floor traders.

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[12] This follows from the same rationale as in our simple example illustrating the appropriateness of conducting a trader-by trader analysis in Section 4.1 (p.9).

5. Dual Trading and Liquidity Supply

One argument against the ban on dual trading is that some of the dual traders affected by the ban might exit the market due to an inability to supplement their income from brokering, by trading for themselves. Their exit could result in illiquid markets and higher trading costs. In this section, we investigate the liquidity-supplying role of dual traders in our sample.

The original enquiry by the CFTC into the practices of the CME in 1989 focused on the issue of the direction of dual traders' personal trades vis-à-vis the direction of their customers' trades.[13] In the same spirit, we too investigate the direction of a dual trader's personal trades in relation to her customers' trades as follows. We define, *DT CTI 1 signed order flow,* as the difference between a dual trader's buy volume and her sale volume on personal account in time interval t, and use it to represent liquidity supplied by the dual trader. *Signed order flow rest market* is the difference between (a) the remaining CTI 1 buy (excluding CTI 1 buy trades made by the dual trader of interest) and all CTI 4 buy trades, and (b) the remaining CTI 1 sale (excluding CTI 1 sale trades made by the dual trader of interest) and all CTI 4 sale trades in time interval t. In essence, *signed order flow rest market* captures the demand for liquidity by the remaining traders on the market in time interval t.

We compute correlations between *DT CTI 1 signed order flow* and *signed order flow rest market.* If dual traders were liquidity providers, we would expect them to be buying when the rest of the market is selling and vice versa, leading to negative and significant correlations between these two signed order flows. Table 2 provides the results. All correlations, across all contracts, are negative and statistically significant, indicating that dual traders' personal trades appear to accommodate liquidity demand from the rest of the market. For example, the mean Pearson correlation coefficients range between -0.3677 for live cattle and -0.9619 for S&P 400 futures.

5.1. *Dual trading and liquidity supply across contracts*

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[13] Also see "Traders are Indicted for Running the Pits by Their Own Rules," WSJ, Aug. 3, 1989, p.1.

We also compare the liquidity-providing role of dual traders across contracts. Note that our set of contracts encompasses the highly active commodity futures such as live cattle and live hogs, as well as the less active financial futures such as Canadian dollars and T-bills. It is useful to investigate if liquidity supply by dual traders is more significant in the lower volume pits. We conduct both t-tests (parametric) and Wilcoxon signed rank (non parametric) tests on the correlations from different contracts in Table 2. Among the eight contracts examined, the most actively traded contract is live cattle, and the least active contract is S&P 400. Live hogs, Canadian dollars, pork bellies, T-bills, feeder cattle, and lumber are in between in trading activity. Several noteworthy results emerge from our pair-wise comparisons across these contracts.

First, we find that in the most actively traded agricultural contracts like live cattle and live hogs, the liquidity-providing role of dual traders is statistically less significant than that of dual traders in the less active contracts. Second, the liquidity-providing role of dual traders in the less active financial contract, T-bill, is statistically more significant than that of dual traders in the agricultural contracts. Third, among dual traders in the moderately traded agricultural contracts pork bellies, feeder cattle, and lumber, we do not find any significant difference in their liquidity-providing role.

In summary, the above results show that, in addition to being liquidity providers overall, dual traders may have a more important liquidity-providing role in lower volume pits.

5.2. *Dual trading and liquidity supply under market stress*

To investigate the robustness of dual traders' liquidity-providing role, we explore whether there are differences when the supply of liquidity is more likely to be strained: times when there are large price changes or when there are fewer locals in the market. Accordingly, we compute correlations between *DT CTI 1 signed order flow* and *signed order flow rest market* during times when there are "large" price swings. We define a price swing as large when the absolute price change in time interval t exceeds the sample average of absolute price changes in a given contract for that day. If dual traders were liquidity providers at times when they are needed most, we should expect to see stronger negative and significant correlations between these two signed order flows. Once again, we do not formally present these results, which are available on request.

Almost all correlations are negative and statistically significant (except a few in the live cattle contract), indicating that dual traders' personal trades tend to be liquidity providing. We also conduct both t-tests (parametric) and Wilcoxon signed rank (non parametric) tests on the difference between the current set of correlations and correlations in Table 2 (the baseline case) and find these two sets of correlations are not statistically different. The implication is that dual traders are at least as strong a liquidity provider during times of large price swings as they are in any situation.

Next, we compute correlations between *DT CTI 1 signed order flow* and *signed order flow rest market* during times when there are "fewer" locals on the market providing liquidity. We define a market to have fewer locals when the number of locals in time interval t is below the sample average of the number of locals in a given contract for that day. If dual traders were liquidity providers at times when fewer locals are present, we would expect to see stronger negative and significant correlations between these two signed order flows. We find evidence that dual traders' personal trades do tend to be liquidity providing. Specifically, upon conducting both t-tests and Wilcoxon signed rank tests on the difference between the current set of correlations and those in Table 2 (the baseline case), we find that the current set of correlations is significantly more negative. That is, dual traders' role as liquidity suppliers appears to become even more important when other liquidity suppliers (such as locals) are in short supply.

6. Dual Trading and Inventory Control

Inventory control models predict (see O'Hara (1995) for a summary of the relevant literature) that market makers manage inventory risk by adjusting bid and ask prices and, over time, their inventory levels revert to a desired level. Manaster and Mann (1996) report a similar behavioral pattern by locals in the futures market. But liquidity provision and inventory control are opposite sides of the same coin. If liquidity supply leads to an increase in personal inventory, then the need to revert back to desired levels will naturally prompt the opposite, or inventory control, behavior. We have already uncovered evidence of liquidity supply behavior by dual traders. In the current section, we investigate the possibility of mean reversion in the inventory of dual traders in our data. Consistent with Fishman and Longstaff (1992), and

Manaster and Mann (1996), we assume that all traders begin the trading day with a zero inventory position. Thus, INVENTORY is computed as a dual trader's own account buy trades minus her own account sale trades, cumulated from the beginning of a trading day to time interval t, assuming that a dual trader has full control of her own account trades only.

We consider a simple time series model of inventory behavior over each 5-minute interval in which the change in INVENTORY during time interval t is regressed on INVENTORY at the start of the time period for each dual trader in our sample. These results (not reported) suggest that dual traders show a strong desire for balancing inventory in their personal trades. Moreover, we also examine the contemporaneous relation between trades and inventory and find that most of the correlations between the start-of-period inventory and subsequent personal trades are negative. The implication is that the most active sellers are traders with long positions, and the most active buyers are traders with shorter inventory positions. Our results are consistent with the intuitions of the inventory control literature in general, and with the results of Manaster and Mann (1996) in particular.

Overall, there appears to be a strong inventory control effect in personal trading by our sample of dual traders complementing their liquidity-supplying role identified in Section 5.

7. Determinants of Dual Traders' Personal Trades

In this section, we examine the determinants of dual traders' personal trades. Our investigation is motivated, on the one hand, by regulators' concerns on whether dual traders should be allowed to trade on their own account and, on the other hand, by a literature that has chosen to examine the various facets of dual trading in isolation. Unfortunately, the latter approach limits our understanding of what fundamentally distinguishes a dual trader from other floor traders like pure brokers. Additionally, within the scope of the current research, it is likely that the magnitude of some of the effects we have examined in isolation could become more or less prominent, once we control for other determinants of the same phenomenon.

Toward this end, the dependent variable in our multivariate analysis reflects the one characteristic that distinguishes a dual trader from a pure broker—her ability to trade on her own account. Thus, NETBUY is defined as the difference between a dual trader's buy volume and her sale volume, on her own account, in time interval t. Our choice of a parsimonious set of exogenous variables is guided by the existing literature (including the current research) that suggests that proxies for information, liquidity provision, and inventory control are possible determinants of a dual trader's NETBUY.

As discussed before, information-related variables for dual traders are captured through inclusion, in the regression model, of a dual trader's *customer netbuy* (defined in Section 4.1) during time intervals t-3 up to t-1, NLAG1 - NLAG3, and those in lead periods t+1 to t+3, NLEAD1 - NLEAD3. The lagged variables should capture the case where a dual trader may trade personally after executing her customers' orders, while the lead variables should capture the situation where a dual trader trades personally before execution of her customers' orders.

The potential conflict of interest between a dual trader's role as a broker and her role as a local is the main argument in favor of a ban on dual trading. The opponents of the ban, however, argue that the cost associated with this conflict of interest has to be traded off against the added liquidity provided by dual traders. We, therefore, examine the relationship between a dual trader's personal trading and her liquidity-providing role by including SVOLR, the *signed order flow rest market* (introduced in Section 5), as a proxy for the liquidity demand by the rest of the market.

Finally, we include the inventory-related variable, INVENTORY (defined in Section 6). According to our earlier results, a dual trader is more likely to buy on personal account if she has a negative inventory position, and sell if her position is positive. We, therefore, expect the coefficient on the inventory variable to be negative.

In summary, our multivariate analysis involves running the following regression:

$$\begin{aligned} NETBUY_t = a_0 + a_1 INVENTORY_{t-1} + a_2 SVOLR_{t-1} + a_3 NLAG1 \\ + a_4 NLAG2 + a_5 NLAG3 + a_6 NLEAD1 + a_7 NLEAD2 + a_8 NLEAD3 + e_t, \end{aligned} \tag{5}$$

on a trader-by-trader basis across the eight futures contracts in the sample. We employ GMM to obtain the autocorrelation- and heteroscedasticity-adjusted coefficient estimates.

Since we have 101 separate sets of coefficient estimates, one for each dual trader in our sample, we present, in Table 3, the numbers of positive and negative coefficients, as well as the numbers of positive and statistically significant and negative and statistically significant coefficient estimates at the (one-sided) 5% level. We also report the average GMM coefficient estimates across traders in the same contract.

Consistent with our earlier results, we find weak evidence that dual traders' personal trades follow their customers' trades. While there are cases that the coefficients on NLAG1 - NLAG3 are positive and statistically significant across the contracts examined, the evidence is weak at best. There is similar weak evidence to support the idea that dual traders' personal trades precede their customers' trades. Specifically, the coefficients on NLEAD1 - NLEAD3 are positive and statistically significant for only a few dual traders across all contracts.

We, however, find strong association between a dual trader's personal trading and SVOLR, our proxy for the market's demand for liquidity. The coefficient on SVOLR is negative and statistically significant across dual traders in the sample, indicating that dual traders meet the market's net buy (sell) demands by selling from (buying into) their personal account. Finally, a dual trader also appears to trade on her own account to actively manage her inventory. The coefficient on INVENTORY is negative and statistically significant for most of the traders in the eight contracts. That is, a dual trader buys on personal account when her inventory position is negative, and sells when it is positive.[14]

As a robustness check, we re-estimate equation (5) with various extensions. For instance, we include additional conditioning variables such as the lagged NETBUY, a skill variable (as defined in Manaster and Mann (1996)), a trade timing dummy (as suggested in Walsh and Dinehart (1991), and Ferguson and Mann (2001)), a measure for market volatility (as in Manaster and Mann (1996)), and *DT customer netbuy* back to time interval *t-8* and forward to time interval *t+8*. It is also possible that dual traders might possess valuable private information beyond that gleaned from observing their customers' orders, due to their innate trading skills, including years of experience both as a broker and as a dealer, and through their network of corporate connections. If so, personal trading based on such information should result in systematic trading profits for the dual trader. Since this private information, if present, is unobservable, we re-estimate (5) with a suitable information proxy.[15] In each case, our main conclusions remain unchanged.

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[14] Notice that the coefficients on SVOLR and INVENTORY are both negative, which may seem counterintuitive at first, given that the former (latter) is a proxy for liquidity supply (inventory control) behavior which takes the dual trader away from (toward) her preferred inventory position. But a closer examination of the definitions of the two variables reveals that SVOLR is the signed order flow of the rest of the market in a given time interval and captures the demand for liquidity by the remaining traders on the market in that time interval. Hence, a negative sign on SVOLR indicates that as the rest of the market has a net demand to sell (SVOLR is negative), the dual trader accommodates this demand by buying, and vice versa—a liquidity supplying behavior. Contrarily, INVENTORY is defined as a dual trader's own account trades cumulated over time—independent of the rest of the market. It is also a cumulative measure, unlike SVOLR, which is a concurrent measure. Hence, a negative sign on INVENTORY indicates that when a dual trader's inventory (from her past own account trading) is high, she is more likely to sell in the next time interval, and vice versa—an inventory control behavior.

In summary, the two significant factors driving dual traders' own account trading, after controlling for all other reasonable proxies, appear to be liquidity provision and inventory control.

8. Concluding Summary

Using detailed and proprietary audit trail transaction data compiled by the CFTC, we seek to investigate, at the individual trader level, the *timing* of dual traders' personal trades in relation to the execution of their customers' orders and the *determinants* of their personal trades. Our analysis reveals a surprising absence of any trade timing by dual traders in relation to the execution of their customers' orders. Further examination employing correlation statistics and time series regressions provides strong support for dual traders as liquidity suppliers and for their inventory control behavior. We also perform individual trader-by-trader regressions of own account trading on factors representing information, liquidity supply and inventory rebalancing, and find that the main motives for own account trading by dual traders are liquidity supply and inventory rebalancing.

Our investigation is timely, given the renewed legislative interest in whether to curb, or

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[15] The information proxy is constructed as follows. Consider the following regression

$$\pi_t = p_0 + p_1 NLAG1 + p_2 NLAG2 + p_3 NLAG3 + w_t,$$

where π_t is the ex-post trading profit of a dual trader in time interval t. Notice, in the above equation, w_t, by construction, is orthogonal to the customers' net buy volume and represents the component of dual trader's trading profit not attributed to customer information. We, therefore, use this residual as a proxy for information that a dual trader may have over and above that from observing her customers' trades. A significant association between a dual trader's NETBUY and the residual w_t would imply that the dual trader is an informed trader, possessing information over and beyond that gleaned from observing her customers' orders.

ultimately to ban, the privilege enjoyed by these traders both to trade on their personal account and to execute customers' orders. A central argument for banning dual trading is that dual traders are informed traders, front running on their customers' orders for private gain. We find no evidence to support such claims. In fact, the emergent profile of a dual trader is that of an uninformed trader trading primarily for liquidity provision and inventory rebalancing reasons. Regulators will, therefore, need to proceed with caution before implementing any restrictions on own account trading by dual traders.

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Table 1: Dual Trading and Information

This table examines the information source of dual traders. We examine the nature of causality between dual traders' personal trades and their customer trades. The criterion for a specific floor trader to be included in our sample as an active dual trader is that the number of her dual trading days exceeds 50, out of a maximum of 126 trading days during the first six months of 1992. Number of traders gives the number of dual traders examined in each contract. We implement the Granger causality test on a trader-by-trader basis. For robustness, the Granger causality test is conducted at 1, 3, and 5 lags using GMM and the Wald Chi-squared test statistic. Beneath each null hypothesis, the cell gives the number of traders in each contract that reject the null at the 5% level.

	Live Cattle	**Hogs**	**Pork Bellies**	**Feeder Cattle**	**Lumber**	**Canadian Dollars**	**T-bill**	**S&P 400**
Number of traders	40	15	18	4	10	7	6	1
	Panel A: H_0: Dual trader's customer trades do not cause dual trader's personal trades (piggybacking)							
One lag	9	2	2	0	1	0	0	0
Three lags	6	1	1	0	1	0	0	0
Five lags	6	0	6	1	1	0	0	0
	Panel B: H_0: Dual trader's personal trades do not cause dual trader's customer trades (front running)							
One lag	1	2	3	1	2	1	0	0
Three lags	4	1	1	2	0	1	0	0
Five lags	3	1	1	1	1	1	1	0

Table 2: Dual Trading and Liquidity Supply

This table examines the liquidity-providing role of dual traders by focusing on the Pearson and Spearman correlations between the dual trader CTI 1 signed order flow and the signed order flow rest market. The criterion for a specific floor trader to be included in our sample as an active dual trader is that the number of her dual trading days exceeds 50, out of a maximum of 126 trading days during the first six months of 1992. Number of traders gives the number of dual traders examined in each contract. DT CTI 1 signed order flow is the difference between a dual trader's buy volume and her sale volume on personal account in time interval t. Signed order flow rest market is the difference between (a) the remaining CTI 1 buy (excluding CTI 1 buy trades made by the dual trader of interest) and all CTI 4 buy trades, and (b) the remaining CTI 1 sale (excluding CTI 1 sale trades made by the dual trader of interest) and all CTI 4 sale trades in time interval t. All correlations are computed on a trader-by-trader basis and the summary statistics of these correlations in terms of mean, median, minimum, and maximum are provided. Number of significant cor gives the number of traders in each contract with significant correlation at the 5% level.

	Live Cattle	**Hogs**	**Pork Bellies**	**Feeder Cattle**	**Lumber**	**Canadian Dollars**	**T-bill**	**S&P 400**
Number of traders	40	15	18	4	10	7	6	1
	Panel A: Pearson cor(DT CTI 1 signed order flow, signed order flow rest market)							
Mean	-.3677	-.3715	-.6076	-.7917	-.7033	-.6214	-.8634	-.9619
Median	-.3477	-.3857	-.5975	-.7989	-.7007	-.6693	-.8635	-.9619
Min	-.8881	-.7781	-.9449	-.9874	-.8880	-.8020	-.9843	-.9619
Max	-.0852	-.1379	-.2607	-.5816	-.5606	-.3346	-.7054	-.9619
Number of significant cor	40	15	18	4	10	7	6	1
	Panel B: Spearman cor(DT CTI 1 signed order flow, signed order flow rest market)							
Mean	-.5550	-.6875	-.8519	-.9172	-.9173	-.9255	-.9567	-.9946
Median	-.5554	-.6726	-.8492	-.9076	-.9180	-.9419	-.9553	-.9946
Min	-.8733	-.8745	-.9608	-.9747	-.9419	-.9542	-.9857	-.9946
Max	-.3313	-.5355	-.7441	-.8790	-.8922	-.8512	-.9329	-.9946
Number of significant cor	40	15	18	4	10	7	6	1

Table 3: Determinants of Dual Traders' Own Account Trading

This table provides an overview of the GMM estimates of a dual trader's own account trading equation (5) across our sample of 101 dual traders in eight futures contracts. The criterion for a specific floor trader to be included in our sample as an active dual trader is that the number of her dual trading days exceeds 50, out of a maximum of 126 trading days during the first six months of 1992. For each futures contract, the first row gives the average coefficient estimates. The second row gives the numbers of positive (+) and negative (-) coefficient estimates, and in parentheses the numbers of significantly positive and negative coefficient estimates, at the 5% level in a one-tailed test. The dependent variable is a dual trader's net buy volume from personal trading (**NETBUY**), which is defined as the difference between a dual trader's buy volume and her sale volume in time interval t. **INVENTORY** is the cumulative difference between a dual trader's own account buy trades and her own account sale trades, from the beginning of a trading day to time interval t-1. **SVOLR** is the signed order flow of the rest of the market in time interval t-1 and is the liquidity proxy. **NLAG1 - NLAG3** are a dual trader's customer net buy volumes in time intervals t-1 up to t-3; and **NLEAD1 - NLEAD3** are a dual trader's customer net buy volumes in time intervals t+1 up to t+3. These lead and lag variables are information proxies.

	INTERCEPT		INVENTORY		SVOLR		NLAG1		NLAG2		NLAG3		NLEAD1		NLEAD2		NLEAD3	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Live Cattle	-.0015		-.0406		-.2149		.0106		.0103		.0076		.0057		.0142		.0009	
	19	21	2	38	0	40	15	25	25	15	16	24	25	15	24	16	22	18
	(1)	(0)	(1)	(28)	(0)	(37)	(3)	(1)	(5)	(1)	(2)	(3)	(1)	(0)	(3)	(0)	(1)	(1)
Hogs	-.0171		-.0461		-.2315		.0028		.0059		.0003		.0114		.0027		.0006	
	2	13	1	14	0	15	8	7	7	8	7	8	9	6	9	6	7	8
	(1)	(2)	(0)	(10)	(0)	(15)	(0)	(0)	(1)	(0)	(0)	(0)	(2)	(1)	(0)	(0)	(0)	(1)
Pork Bellies	.0100		-.0460		-.4702		-.0061		-.0041		.0066		-.0004		.0075		.0047	
	10	8	0	18	0	18	8	10	9	9	12	6	13	5	9	9	11	0
	(0)	(1)	(0)	(14)	(0)	(18)	(0)	(2)	(0)	(1)	(1)	(0)	(1)	(0)	(3)	(2)	(10)	(0)
Feeder Cattle	.0203		-.0210		-.6971		.0008		.0018		-.0005		.0022		.0015		.0008	
	3	1	1	3	0	4	2	2	2	2	2	2	3	1	3	1	3	1
	(0)	(0)	(0)	(3)	(0)	(4)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Lumber	-.0127		-.0770		-.5022		.0003		-.0019		-.0004		.0024		.0002		-.0085	
	2	8	0	10	0	10	4	6	5	5	3	7	6	4	6	4	3	7
	(0)	(0)	(0)	(6)	(0)	(10)	(0)	(0)	(0)	(1)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(1)
Canadian Dollars	-.0562		-.0286		-.4084		-.0021		-.0017		-.0017		.0010		.0001		.0008	
	0	7	0	7	0	7	2	5	1	6	2	5	5	2	4	3	3	4
	(0)	(2)	(0)	(7)	(0)	(7)	(0)	(1)	(0)	(1)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)
T-bill	-.0123		-.0016		-.5626		-.0011		. .0009		-.0010		.0013		.0011		.0013	
	4	2	3	3	0	6	3	3	3	3	2	4	4	2	3	3	4	2
	(0)	(1)	(0)	(0)	(0)	(6)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
S&P 400	.0063		-.0384		-.8682		.0002		.0002		.0006		.0002		-.0021		-.0016	
	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	1	0	1
	(0)	(0)	(0)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)

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-1996-

1082 Murat Koksalan, Oya Rizi, A VISUAL INTRACTIVE APPROACH FOR MULTIPLE CRITERIA DECISION MAKING WITH MONOTONE UTILITY FUNCTIONS

1083 Janet S. Netz, John D. Haveman, ALL IN THE FAMILY: FAMILY, INCOME, AND LABOR FORCE ATTACHMENT

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1089 Thomas H. Brush and Philip Bromiley, WHAT DOES A SMALL CORPORATE EFFECT MEAN? A VARIANCE COMPONENTS SIMULATION OF CORPORATE AND BUSINESS EFFECTS

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-1997-

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- 1998 -

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1119 Charles Noussair, Stéphane Robin and Bernard Ruffieux, BUBBLES AND ANTI-CRASHES IN LABORATORY ASSET MARKETS WITH CONSTANT FUNDAMENTAL VALUES

1120 Vivian Lei, Charles N. Noussair and Charles R. Plott, NON-SPECULATIVE BUBBLES IN EXPERIMENTAL ASSET MARKETS: LACK OF COMMON KNOWLEDGE OF RATIONALITY VS. ACTUAL IRRATIONALITY

-1999-

1121 Kent D. Miller and Timothy B. Folta, ENTRY TIMING AND OPTION VALUE

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1123 Timothy B. Folta and David A. Foote, TEMPORARY EMPLOYEES AS REAL OPTIONS

1124 Gabriele Camera, DIRTY MONEY

1125 Wilfred Amaldoss, Robert J. Meyer, Jagmohan S. Raju, and Amnon Rapoport, COLLABORATING TO COMPETE: A GAME-THEORETIC MODEL AND EXPERIMENTAL INVESTIGATION OF THE EFFECT OF PROFIT-SHARING ARRANGEMENT AND TYPE OF ALLIANCE ON RESOURCE-COMMITMENT DECISIONS

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-2000-

1127 Sugato Chakravarty and Kai Li, AN ANALYSIS OF OWN ACCOUNT TRADING BY DUAL TRADERS IN FUTURES MARKETS: A BAYESIAN APPROACH

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1130 Sugato Chakravarty and Asani Sarkar, THE DETERMINANTS OF LIQUIDITY IN U.S. CORPORATE, MUNICIPAL AND TREASURY BOND MARKETS

1131 Vivian Lei and Charles Noussair, AN EXPERIMENTAL TEST OF AN OPTIMAL GROWTH MODEL

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1138 Sugato Chakravarty, Asani Sarkar, DO DIFFERENCES IN TRANSPARENCY AFFECT TRADING COSTS? EVIDENCE FROM U.S. CORPORATE, MUNICIPAL AND TREASURY BOND MARKETS

-2001-

1139 Charles Noussair, Stephane Robin, Bernard Ruffieux, GENETICALLY MODIFIED ORGANISMS IN THE FOOD SUPPLY: PUBLIC OPINION VS CONSUMER BEHAVIOR

1140 Gabriele Camera, SEARCH, DEALERS, AND THE TERMS OF TRADE

1141 David Masclet, Charles Noussair, Steven Tucker, Marie-Claire Villeval, MONETARY AND NON-MONETARY PUNISHMENT IN THE VOLUNTARY CONTRIBUTIONS MECHANISM

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1145 William Blankenau, Gabriele Camera, PRODUCTIVE EDUCATION OR A MARKETABLE DEGREE?

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