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The Performance and Market Impact of Dual Trading: CME Rule 552*

ERIC C. CHANG

Georgia Institute of Technology, Atlanta, Georgia 30332-0520

AND

PETER R. LOCKE

Commodity Futures Trading Commission, 2033 K Street NW, Washington, DC 20581

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This paper analyzes dual trading on futures contracts restricted by Chicago Mercantile Exchange Rule 552. Using floor trader data, several categories of traders are identified, and differences in strategies and profitability are examined. When unrestricted, dual traders execute most customer orders and few personal trades. The evidence supports the hypothesis that dual traders are superior brokers. However, there is no evidence of informational advantages in dual traders' personal trading. Dual traders are shown to provide liquidity with their personal trades. Finally, Rule 552 does not appear to have increased trading costs. *Journal of Economic Literature* Classification Numbers: G12, G13, D82. © 1996 Academic Press, Inc.

Dual trading on futures exchanges is a continuing controversy. It occurs when floor traders execute trades for themselves and for customers in the same contract. Thus, dual trading involves a possible conflict of interest between a trader's proprietary goals and fiduciary responsibilities. This

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conflict was highlighted in 1989 as a result of FBI sting operations aimed at futures floor traders. In May 1991, the Chicago Mercantile Exchange (CME) implemented Rule 552 prohibiting dual trading on certain CME futures and options contracts.[1] The restriction applies to contracts with recent histories of high volume (an average of at least 10,000 contracts per day), and prohibits floor traders from trading for customers and on their own account in these contracts within the same day.[2] We use this event to examine the practice of dual trading and its economic role in futures markets.[3]

Some of the economic costs and benefits of dual trading and the likely effects of restricting it are presented in Grossman (1989), Fishman and Longstaff (1992), and Sarkar (1994).[4] Grossman (1989) posited dual traders to be relatively skillful floor traders who offer flexibility in the presence of varying liquidity demands. The elimination of dual trading would decrease the number of brokers, marketmakers, and market liquidity, leaving futures customers worse off. Grossman reasoned that competition among floor traders should be a market mechanism deterring abuses of the broker's fiduciary responsibilities.

Fishman and Longstaff (1992) develop a model of dual trading assuming that some floor traders are able to distinguish partially between likely informed and likely uninformed customers. Dual traders rationally mimic

[1] Prior to Rule 552, dual trading generally had been permitted on U.S. futures exchanges with two exceptions. First, a floor trader holding an immediately executable customer order could not execute a personal trade in that commodity until the customer order had been filled, or had become not immediately executable (as with a limit order whose limit price is surpassed by the market price). Second, since June 1987, floor traders standing on the top step of the CME's S&P 500 futures pit (in sight of the order clerks) could not execute a personal trade in the lead month. Otherwise, floor traders on futures exchanges are free to allocate their time and energy within a day between personal trading and executing customer orders in a variety of commodities and options, depending on their membership privilege.

[2] Exceptions are allowed for spread traders and traders who obtain written customer consent.

[3] While futures may be traded through a variety of institutions, the dual trading question investigated in this study mainly relates to the pit-based markets such as exist in Chicago, New York, and elsewhere, described in detail by Smidt (1985). Prior to the CME's actions, dual trading was generally allowed on these markets, with a proscription against frontrunning or disclosure of customer orders.

[4] One early investigation into liquidity and dual trading (albeit with respect to stock exchanges) is a 1936 report by the Securities and Exchange Commission, largely the work of David Saperstein. This analysis was concerned with the role of the broker-dealer on stock exchanges and whether the (supposed) provision of liquidity by these firms justified the potentials for trading abuses. The report recommended a cautious approach in regulating the broker-dealer. Saperstein pointed out that while liquidity is clearly one sign of a market's health, there are others which have to be traded off by a regulator in the process of creating an optimal market structure. Stanley (1981) described the costs and benefits of dual trading, pointing out that the major benefit is the intraday market flexibility between broker and marketmaker.

the trades of likely informed customers with a personal trade, benefiting from the customer's information advantage.[5] In a competitive setting, this benefit is offset by lower floor brokerage (for all customers) charged by dual traders. Moreover, the personal trading of dual traders increases the informational content of price through their mimicking. Due to the informational role of dual traders in this model, uninformed customers are better off in the presence of dual trading whereas informed customers are better off without dual trading. Increased market liquidity is not necessarily an outcome of dual trading in Fishman and Longstaff (1992) since the optimal mimicking strategy has the effect of exacerbating the adverse selection problem faced by marketmakers.

Sarkar (1994) relaxes the quantity constraint in the Fishman–Longstaff model and shows that dual traders who mimic informed customers worsen the marketmakers' informational disadvantage, thereby reducing market depth. This observation, when coupled with Grossman's original assertion about the fall in the number of marketmakers, adds a bit of uncertainty to the liquidity effects of a dual trading ban. In particular, while a dual trading ban will likely reduce the available number of marketmakers, this cost may be offset by a mitigation of the remaining marketmakers' information disadvantage.

Empirical analyses of the effects of dual trading, or a ban on dual trading in futures markets, are inconclusive. Two early studies, Commodity Futures Trading Commission (1989) (CFTC) and Chicago Mercantile Exchange (1989), find that dual trading is not a significant factor in determining market liquidity. The CFTC also fails to detect any trading superiority attributable to dual traders. Fishman and Longstaff (1992), using soybean trading data, find that customer liquidity costs are lower when their orders are executed by dual traders than by pure brokers, whereas trading profits of dual traders are higher than those of traders who only execute personal trades.[6] Smith and Whaley (1994) find that the "top step" rule (an effective prohibition on dual trading) has decreased liquidity in the S&P 500 futures.

At the core of the debate regarding the market impact of a ban on dual trading are dual traders' personal trading strategies. If dual traders are generally making a market with their personal trades, then, as pointed out by Grossman (1989), a dual trading restriction has the potential to reduce

[5] Fishman and Longstaff (1992) also consider the case where the trader trades ahead of the informed customer.

[6] Walsh and Dinehart (1991) find that dual traders enhance soybean futures liquidity with no noticeable effect on two other Chicago Board of Trade contracts. Chang *et al.* (1994) examine the personal costs of a dual trading restriction on a set of traders engaged in dual trading. They confirm that dual traders tend to incur real economic losses when their trading strategies are restricted.

market liquidity.[7] Alternatively, if dual traders' personal trading is information based (mimicking or frontrunning), a dual trading restriction would reduce the informational disadvantage of other marketmakers and may increase market liquidity.

This study provides an empirical analysis of dual trading on futures contracts restricted by CME Rule 552 and examines these dual traders' personal strategies, and hence their economic role in futures markets. We first document the extent to which dual trading exists in four currencies and Eurodollar futures markets in the 6 months prior to the implementation of Rule 552. Toward this end, we identify several groups of dual traders based on the trader's daily ratio of personal trading to total trading volume. This distinction is important since the behavior of dual traders who primarily execute customer orders may differ substantially from that of those whose main business is personal trading. These behavioral differences may lead to differential order execution, profitability, and customer transaction costs. This is the first empirical study in which the distinction of dual trader types is made.

Next, we compare the trading performances of each group of dual traders in customer trade execution and personal trading. These performances are compared to those of pure brokers and pure locals. This provides a test of some of the predictions of the models of Fishman and Longstaff (1992) and Grossman (1989) regarding dual traders' skill at order execution and their relative ability to extract valuable information from customer trades.

We then analyze the extent to which various groups of dual traders provide or demand liquidity in facing customer order imbalances. Thus far, the extent to which the widely cited conflict of interest exists in the futures market has not been carefully documented. To measure the effect, we divide each trading day into 26 15-minute trading intervals and examine the relationship between customers' and dual traders' transaction imbalances using customers' net transactions (long minus short) relative to total volume as a proxy for liquidity demand.

Finally, we use the implementation of CME Rule 552 as a means of assessing the relationship of the dual trading market system to market liquidity. While a dual trading ban may reduce market liquidity by decreasing the available number of marketmakers, this cost may be offset by a mitigation of the remaining marketmakers' information disadvantage. Our hypothesis that there is no effect of a dual trading restriction on market liquidity is tested using an empirical model of the determinants of the bid–ask spread and data from before and after the rule change. In addition,

[7] Kuserk and Locke (1991) document the behavior and profitability of marketmakers on the CME, expanding on the analysis of Silber (1984).

we estimate the effect of Rule 552 on the number of marketmakers in the affected pits.

Our results reveal that, in the prerule period, a majority of customer trades in these markets are handled by dual traders, and that the personal trading volume of these dual traders is relatively small. We find some evidence of superior customer order execution by dual traders relative to pure brokers while their personal trading appears inferior to pure locals. Dual traders appear to supply liquidity with their personal trading although collectively they are not the major liquidity providers. However, on a per-trader basis, their liquidity provision is similar to that of marketmakers. Finally, while we do find that the number of marketmakers declined as a result of Rule 552, we find no evidence that the implementation of Rule 552 has significantly increased the bid–ask spread in these markets.

Section 1 describes our data and the categorization of traders. Section 2 documents the extent to which dual trading existed in four currencies and Eurodollar futures markets in the 6 months prior to the implementation of Rule 552. The relative trading performance of each group of dual traders in customer trade execution and personal trading is also assessed. Section 3 examines the extent to which the personal trading of dual traders provides liquidity in a manner similar to marketmakers. Section 4 assesses the effect of the dual trading restriction on the bid–ask spread. Section 5 summarizes our results and the policy implications of the analysis.

1. DATA

Our data are from the computerized trade reconstruction (CTR) records maintained by the CFTC. These records indicate for each transaction the identity of the executing floor traders, the price and number of contracts in the transaction, and the principals behind the trade by type (the floor trader, the floor trader's clearing member, another floor trader, any other type of customer). These records enable us to identify all transactions made by each floor trader for their customers, personal accounts, and others over the sample period.[8]

Rule 552 applies to the particular contract month "position" (lead, second position, etc.) of a commodity which has a recent history of high volume. The terms lead or first position and second position typically refer to time-to-maturity relative to other contract months, but also take trading volume into consideration. The designation of lead contract is determined by the

[8] This data source was previously employed in the analysis of dual trading. However, the CFTC (1989) and Fishman and Longstaff (1992) relied on a 15-day sample whereas we analyze approximately 1 year of transactions data surrounding the implementation of Rule 552.

pit committee, and this designation changes on a rollover date prior to expiration determined by the CME Board of Directors or the pit committee.[9]

As of December 1991, five commodities had been affected by Rule 552: pound sterling, Swiss franc, Japanese yen, Deutsche mark, and Eurodollars. The first two positions of Eurodollars were originally restricted with the third position contract added later. We divide our analysis into two sample periods: (1) a prerule period running from November 1, 1990 until April 30, 1991, and (2) a postrule period running from June 10, 1991 until November 30, 1991. The period surrounding the rule change, from May 1, 1991 to June 9, 1991, is excluded in order to avoid any ''trader adjustment'' effects around the implementation date, May 20 (see Chang *et al.*, 1994). June 10 was chosen as the initial date of the postrule period since this day is a rollover date for the currencies. When the June 1991 (September 1991) contracts become unrestricted for the 5 days remaining until expiration, the September 1991 (December 1991) contracts become restricted.[10]

Our analysis uses data for the contract months which were subject to the restriction, that is, lead months for currencies, and lead- and second-position contracts for Eurodollars. In the postrule period, we switch contract positions (lead, second position, etc.) based on the rollover dates established by the CME. We use similar dates in the prerule period to roll the lead- and second-position contracts forward. Both the pre- and postrule samples cover two contract cycles for the currencies and Eurodollars. The original data set for the five commodities contains more than 10 million records.

Each floor trader is categorized on the basis of the ratio of personal to total volume executed in the contract each day. Based on this ratio we identify Brokers (those with no personal trades for the day), Locals (only personal trades for the day), and three categories of dual traders: Near-Brokers (less than 20% but some personal trading volume), Mixed (between 20 and 80% personal trades), and Near-Locals (greater than 80% personal trades but some broker activity).[11] This separation of dual traders allows us to isolate Near-Brokers, who have the greatest access to customer orders,

[9] Generally, the lead contract will be the most active with the rollover date approximately 1 week prior to expiration for the currencies. On that date the contract closest to expiration ceases to be the lead contract.

[10] June, September, and December 1991 Eurodollars were restricted beginning May 20, 1991, while March 1992 was restricted as of August 2, 1991, and June 1992 was restricted as of October 30, 1991.

[11] At the outset we sought to determine the sensitivity of our results to the group definition. In particular, some brokers may have personal accounts in which to place and offset errors which they make in the execution of customer trades. Results using a ''2% or less'' definition of a pure broker and ''2–20%'' definition of a Near-Broker were qualitatively similar to the definitions we use in the paper. The 20 and 80% levels were chosen with the intention of having ample sample size, without mixing the types of traders.

and stand to benefit the most from information. To facilitate comparison with prior research we also combine the three dual trader groups into an All Dual category. CME floor trading cards used for personal trading have a 15-minute bracket indicator written on them, so in the interest of accuracy we use a 15-minute frequency as our basic time unit of analysis.

2. THE PREVALENCE AND PERFORMANCE OF DUAL TRADING

In this section we establish the magnitude of dual trading prior to the implementation of Rule 552 and evaluate the relative order execution performance of various floor traders (brokers, dual traders, locals), for personal trading and customer trades.

We calculate the daily trading volume for personal and customer accounts by the five floor trader groups described above and report the average of these over the period from November 1990 through April 1991 in Table I. This table also presents the average daily number of traders identified in each group. Below the group's trading volume is the average percentage of that type of volume executed by the respective trader group. Customer and personal trading make up approximately 90% of the total volume on these contracts, with remaining volume from clearing members and floor traders trading for other floor traders.

For these contracts, the majority of customer volume, on average around 60%, is executed by Near-Brokers, as shown in column 3 of Table I. These statistics do not suggest a great customer concern over the potential conflict of interest. On the other hand, column 12 reveals that on average approximately 80% of total personal trading is executed by Locals, floor traders who during a particular day only execute personal trades. Near-Brokers execute only a small percentage (less than 7.2%) of personal volume on average. If personal trading by all floor traders in these markets tends to provide liquidity equally, the relative contribution made collectively by dual traders may be small. There is strong evidence of floor trader specialization in these markets as there are few traders on average who equally mix customer and personal trading. Finally, note that the largest number of traders are in the Local category. This apparent specialization may be due to the trading rules described in Footnote 1.

We next investigate the relative trading performance of each dual trading group with respect to the execution of customer and personal orders. Since per-trader volume varies from group to group, the performance evaluation will be based on profit per contract, a measure employed in Fishman and Longstaff (1992). For each trader in each group we first calculate daily personal and customer trading revenue respectively. We do this for each

TABLE I

FLOOR TRADER POPULATION, VOLUME, AND PERCENTAGE OF CONTRACTS EXECUTED BY FLOOR TRADER GROUP

	Broker No personal volume		Near-Broker Less than 20% personal volume			Mixed 20–80% personal volume			Near-Local More than 80% personal volume			Local No customer volume		All Traders	
Commodity	(1) Cust. (%)	(2) No.	(3) Cust. (%)	(4) Personal (%)	(5) No.	(6) Cust. (%)	(7) Personal (%)	(8) No.	(9) Cust. (%)	(10) Personal (%)	(11) No.	(12) Personal (%)	(13) No.	(14) Cust.	(15) Personal
(1) Pound sterling	3,124.3	21.65	6,981.3	627.7	11.65	1128.1	872.0	5.18	37.3	595.3	1.87	7,268.2	26.60	11,279.1	9,363.2
	27.5		61.9	6.7		10.0	9.3		0.5	6.3		77.6			
(2) Deutsche mark	11,362.0	43.76	14,454.3	845.0	15.09	927.9	1032.9	4.93	11.7	873.0	3.15	20,527.9	77.29	26,797.2	23,278.8
	42.4		54.0	3.6		3.5	4.4		0.0	3.8		88.2			
(3) Japanese yen	7,170.1	40.22	12,065.3	762.2	16.06	418.1	482.9	2.75	12.6	820.3	2.90	17,036.0	61.53	19,698.0	19,101.4
	36.4		61.4	4.0		2.1	2.5		0.0	4.3		89.2			
(4) Swiss franc	4,186.4	29.81	12,264.8	1105.2	18.77	1793.4	1698.6	5.62	69.7	646.2	2.36	14,097.1	55.90	18,606.2	17,847.1
	22.9		61.4	6.2		9.8	9.5		0.4	5.3		79.0			
(5) Lead Eurodollar	9,515.6	30.72	24,621.4	3640.9	21.41	7060.3	8107.0	14.40	61.0	2308.7	3.02	36,573.4	101.01	41.193.1	50,630.0
	23.11		59.7	7.2		17.1	16.0		0.0	4.6		72.2			
(6) 2nd position Eurodollar	6,039.3	19.60	14,785.0	2316.4	13.90	4679.3	5209.8	8.98	37.2	1657.5	2.12	25,625.4	68.89	25,590.3	34,809.1
	23.6		57.9	6.5		18.3	15.0		0.0	4.8		73.6			

Note. For each trading day from 11/1/90 to 4/30/91 we measure the number of traders and the daily number of contracts executed in the lead contract, including buys and sells. For Eurodollars we also calculate activity in the second position contract which was also restricted by Rule 552. We sum daily contracts traded by each group, as well as the number of floor traders identified daily in each group. Below each average is the percentage of total contracts (customer, personal) executed on average by this group. The floor trader groups are determined by the ratio of an individual's personal trading volume to their total volume over each day.

day by subtracting the total value of purchases from the total value of sales for each type of trade and marking any daily net trading to market at the settlement price. Daily trading revenue is then divided by the number of round trips (matched buys and sells after marking to market) to form the daily profit per-contract for each trader. We then calculate averages by trader groups and test several hypotheses regarding dual traders' relative trading abilities.

For customer order execution, Grossman (1989) asserts that customers using brokers who also risk their own money through personal trading obtain an advantage over using pure brokers in terms of better trade timing, lower search costs, and improved bargaining ability. As a test, we compare the per-contract profits for customer orders executed by different dual trader groups and pure brokers. The null hypothesis is that the skills for executing customer orders of dual traders and brokers are the same, leading to similar trading profits for customers of these floor trader groups.

Average customer trading profit, in dollars per contract by trader group, and the results of testing for equality in execution skills are presented in Table II. In the absence of superior information, we expect estimates of average customer trading profit to be negative, since public customers in aggregate should be paying a liquidity premium. Without exception, when customer orders are executed by pure brokers, all six average per-contract profits are negative. The average costs for customers using Brokers are in the neighborhood of $10, except for Eurodollars, where these costs are considerably smaller.

However, when customer orders are executed by dual traders, half of the 18 average per-contract profits reported in Table II are positive. In the even columns of Table II we present the difference between the average trading profits for customer orders executed by Brokers and by the respective dual trader groups. The *t*-statistic in parentheses is a test of the hypothesis that the difference between the mean customer trading profits for dual traders and pure brokers is zero.

Row 5 of Table II contains this difference and the test statistic for All Dual. Point estimates of the difference in means are negative for all six commodities. For Deutsche marks, this difference is significant at the 10% level. Row 2 contains the results for Near-Brokers, dual traders who predominantly fill customer orders. Five of the six point estimates of the difference in means are negative. For Swiss francs and Deutsche marks, Near-Brokers are significantly superior in their order execution relative to Brokers. While this finding is consistent with the hypothesis of superior execution skills for dual traders, an alternate explanation for the results is that Near-Brokers' customers are better informed than Brokers' customers on average. Our data do not allow for a distinction between these hypotheses. In general, the customer order execution data by trader groups for five

TABLE II

Daily Profit per Contract for Customer Trading

	Pound sterling		Deutsche mark		Japanese yen		Swiss franc		Lead Eurodollar		2nd position Eurodollar	
Floor trader group (% personal volume)	(1) Mean (Obs.)	(2) Difference (*t*-stat.)	(3) Mean (Obs.)	(4) Difference (*t*-stat.)	(5) Mean (Obs.)	(6) Difference (*t*-stat.)	(7) Mean (Obs.)	(8) Difference (*t*-stat.)	(9) Mean (Obs.)	(10) Difference (*t*-stat.)	(11) Mean (Obs.)	(12) Difference (*t*-stat.)
(1) Broker	−13.002		−8.930		−10.561		−6.821		−0.358		−2.732	
(0%)	1083		2616		2072		1505		1991		1694	
(2) Near-Broker	−12.401	−0.601	1.298	−10.228	−3.263	−7.298	8.569	−15.390	1.289	−1.647	−6.048	3.316
(less than 20%)	1405	(−0.054)	1820	(−1.999)**	1864	(−1.136)	2263	(−1.919)*	2456	(−0.3975)	1923	(0.72260)
(3) Mixed	10.797	−23.799	2.725	−11.655	7.866	−18.427	−21.284	14.463	−2.304	1.946	5.607	−8.339
(20 to 80%)	567	(−1.666)*	440	(−1.134)	244	(−1.329)	583	(1.368)	1369	(0.4112)	911	(−1.4957)
(4) Near-Local	−21.394	8.392	−31.252	22.322	−49.996	39.435	1.563	−8.384	1.583	−1.941	−30.502	27.770
(more than 80%)	71	(0.2934)	61	(1.033)	88	(1.081)	79	(−0.330)	45	(−0.903)	32	(1.1411)
(5) All Dual	−6.275	−6.727	0.713	−9.643	−3.899	−6.662	2.430	−9.251	0.021	−0.379	−2.616	−0.116
	2043	(−0.633)	2321	(−1.929)*	2196	(−1.046)	2925	(−1.200)	3870	(−0.0992)	2866	(−0.0272)

Note. For each trading day from 11/1/90 to 4/30/91 in which a member of the group both bought and sold for customer accounts, trading profit is calculated as the average price at which the member sold a customer contract minus the average price at which the member purchased a customer contract. The trader's net customer position is marked-to-market at the end of each day to the settlement price. The average is for trader-days, conditional on the trader having traded on the day. We perform the test that the dual trader group mean is equal to the Broker group mean and report the *t*-statistic in parentheses.

** Significance at the 5% level.

* Significance at the 10% level.

financial futures complement Fishman and Longstaff (1992), who provide evidence that customers do better on days when their brokers also trade for their own account in soybean futures.[12] Perhaps of greater interest to policy makers, we find no evidence that customers who use dual traders receive inferior execution.

To shed light on the value of dual traders' informational advantage, Table III contains results for floor traders' personal trading profit with a format similar to that of Table II. Locals, as defined above, did not trade for any outside customers on the day. We assume that they had no direct access to the order flow of those customers who were likely to be informed. We test the null hypothesis that the mean locals' and dual traders' personal per contract profits are equal. Note that this test is independent of the test for customer trading costs. Skills involved in order execution will be valuable for both types of trading, but customer trading involves no discretion on the broker's part while personal trading is highly discretionary. We expect the average trading profit for personal trades to be positive in general, reflecting the receipt of a liquidity premium. Without exception, the average personal trading profit (in the odd columns of Table III) across trader groups and commodities is positive. Row 1 presents average trading profits for locals. Across the currencies these average profits are similar, near $8 per contract, or about two-thirds of a tick. In Eurodollars, average trading profit for Locals is only $4.60 per-contract, or less than one-fifth of a minimum tick.

Analogously to Table II, the even columns of Table III present differences between the average personal trading profit for locals and dual trader groups, with *t*-statistics in parentheses. Assuming equal order execution skill, locals' average trading profit is the expected income from executing one contract should traders in a dual trader group attempt the Locals' personal trading strategy. In this sense the Locals' trading profit can be viewed as the opportunity cost of choosing a personal trading strategy other than market making. If per-contract revenues from personal trading across groups are not significantly different, then we cannot reject the hypothesis that all groups are following the Locals' market-making strategy. A significant negative value for this difference would support the alternative hypothesis that dual traders are informed or have better personal trading skills. Row 5 presents the results for All Dual. The evidence does not support the hypothesis that dual traders in these markets execute trades on the basis of informational advantages. All six mean differences in row 6 are positive. In the case of the Japanese yen, Locals significantly outperform All Dual traders in terms of average personal trading profit.

[12] The failure to find significant differences in all commodities may reflect differences in market structures across various commodities or exchanges.

TABLE III

AVERAGE DAILY PROFIT PER CONTRACT FOR PERSONAL TRADING

	Pound sterling		Deutsche mark		Japanese yen		Swiss franc		Lead Eurodollar		2nd position Eurodollar	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Floor trader group (% personal volume)	Mean (Obs.)	Difference (*t*-stat.)	Mean (Obs.)	Difference (*t*-stat.)	Mean (Obs.)	Difference (*t*-stat.)	Mean (Obs.)	Difference (*t*-stat.)	Mean (Obs.)	Difference (*t*-stat.)	Mean (Obs.)	Difference (*t*-stat.)
(1) Local	8.109		8.182		8.347		8.059		4.606		4.621	
(100%)	3079		8796		6945		6514		11140		9283	
(2) Near-Broker	11.535	−3.426	4.621	3.561	5.470	2.877	10.307	−2.248	2.956	1.650	1.669	2.952
(less than 20%)	1388	(−0.935)	1747	(1.722)*	1882	(1.214)	2230	(−0.907)	2283	(1.1609)	1861	(2.0966)**
(3) Mixed	3.830	4.279	10.109	−1.920	5.391	2.956	12.542	−4.483	3.638	0.968	4.406	0.215
(20 to 80%)	634	(1.213)	584	(−0.364)	318	(0.753)	677	(−1.222)	1714	(0.7384)	1249	(0.1421)
(4) Near-Local	2.096	6.013	3.951	4.231	0.292	8.055	0.155	7.904	2.012	2.594	10.645	−6.024
(more than 80%)	232	(1.041)	383	(0.942)	350	(1.519)	291	(1.263)	354	(0.9349)	304	(−1.6237)
(5) All Dual	8.396	−0.287	5.708	2.474	4.749	3.598	9.857	−1.798	3.148	1.458	3.469	1.152
	2254	(−0.097)	2714	(1.251)	2550	(1.706)*	3198	(−0.837)	4351	(1.4127)	3414	(1.0272)

Note. For each trading day from 11/1/90 to 4/30/91 in which a member of the group both bought and sold for their personal account, trading profit per contract is calculated as the average price at which the member sold a contract minus the average price at which the member purchased a contract. Accounts are marked-to-market at the end of the day to the settlement price. The floor trader groups are determined by the individual's trading during the day. We test whether the dual trader group mean is equal to the Local group mean, and report the *t*-statistic in parentheses.

** Significance at the 5% level.

* Significance at the 10% level.

Row 2 of Table III contains the average personal per-contract profits for Near-Brokers, and the results from tests of the hypothesis that the mean personal per-contract trading profit for Near-Brokers and Locals is equal. Due to their relatively high customer volume, these dual traders have the greatest access to any likely informed customer orders. In no instance is the Near-Brokers average trading profit significantly higher than that of Locals. For Deutsche marks and second position Eurodollars the Near-Broker's average trading profit per contract is significantly less than that of Locals.

A critical assumption in the Fishman and Longstaff (1992) model is the *ex ante* distribution of information which leads to a profitable mimicking strategy for dual traders. While we cannot rule out the existence of such strategies in these futures markets, our results are consistent with the notion that the mimicking strategy is either ineffective or absent among dual traders in these markets. Information-based trading may be more of a factor in agricultural futures, where there is scarce intraday cash market information available to floor traders. Floor traders in financial futures pits enjoy inexpensive access to continually updated public information. Harvey and Huang (1991) point out that the determinants of foreign exchange rates (and futures) are generally publicly available information, such as interest rate differentials. Our results bring into question the assumptions of the Fishman and Longstaff (1992) dual trading model as applied to financial futures.

3. LIQUIDITY PROVISION BY DUAL TRADERS

This section seeks to infer floor traders' personal trading strategies at the aggregate level by examining their net positions in the presence of unbalanced customer trading. Dual trading proponents often point to the flexible response of dual traders to market making and customer order execution demands. Working (1967) in particular states that those floor traders who act as marketmakers temporarily absorb customer imbalances, which implies a negative relationship between marketmaker trading and customer trading. In contrast, the Fishman and Longstaff dual trading model posits a customer-mimicking strategy for dual traders which implies a nonnegative correlation between dual traders' personal trading and customer trading. In Section 2 we found that dual traders' personal trading profits appeared to be less than that of Locals, suggesting little if any informational advantage for dual traders. In this section we further investigate the likelihood that dual traders are market making when they execute personal trades.

We examine the market-making hypothesis and the contribution to the supply of liquidity by the personal trading of floor trader groups using the regression model

$$L_{it} = \gamma_{0i} + \gamma_{1i} C_t + \varepsilon_{it}, \tag{1}$$

where L_{it} is the sum of the signed personal volume (i.e., buys minus sells) for floor trader group i measured over the 15-minute interval t, C_t is the sum of signed outside customer volume in the interval, and ε_{it} is the regression error. High-frequency data are critical for this analysis, since net personal and customer trading will each tend toward zero over longer time intervals. Signed customer volume is summed over all floor traders. The dependent variable, L_{it}, measures the change in a group's net inventory over interval t, and C_t represents the aggregate (excess) demand for liquidity by customers. The coefficient γ_{1i} represents group i's marginal propensity to supply liquidity.

In a second specification we divide the group's net inventory change by N_{it}, the number of members of group i trading in the interval

$$\frac{L_{it}}{N_{it}} = \eta_{0i} + \eta_{1i} C_t + u_{it}. \tag{2}$$

This second specification allows us to compare across groups liquidity contribution on a per-trader basis. The coefficient, η_{1i}, represents a typical trader's propensity to supply liquidity, which may depend on risk preferences, capitalization, etc. If traders within group i are generally market making with their personal trades, then both γ_{1i} and η_{1i} will be significantly less than zero, with the ratio related to the average number of traders in the group. We present the results for the second specification comparing Locals to All Dual traders.

Since trading volume is not uniformly distributed either within a day or across days of the week, we estimate both models using weighted least-squares to mitigate problems of heteroskedasticity. The weighting variable is 1000 times the reciprocal of total customer volume for the interval. The results from these regressions are presented in Tables IVA–IVC. Table IVA contains the results of a regression using broadly defined groups. The personal trading groups represented here are Locals and All Dual traders. In addition, we present the results of regressions using clearing member trading and trading by floor traders for other floor traders. Clearing member trading is the aggregate trading by brokers for their clearing member firms' proprietary accounts. The ''Other floor'' category indicates an order executed by a floor trader for another trader present on the exchange floor,

TABLE IVA
LIQUIDITY PROVISION BY MAJOR TRADER GROUP

Trader group	Commodity	(1) γ_0 (SE)	(2) γ_1 (SE)	(3) Adj.-R^2
(1) All Dual	Pound sterling	−0.5358 (0.2249)*	−0.0393 (0.0039)*	0.0309
	Deutsche mark	0.4047 (0.3533)	−0.0290 (0.0029)*	0.0301
	Japanese yen	0.0143 (0.4370)	−0.0373 (0.0041)*	0.0255
	Swiss franc	−0.0303 (0.3803)	−0.0423 (0.0040)*	0.0343
	Eurodollar (nearby)	−6.9428 (1.4192)*	−0.1257 (0.0086)*	0.0659
	Eurodollar (first)	1.3091 (1.1042)	−0.0953 (0.0081)*	0.0453
(2) Local	Pound sterling	−0.1290 (0.6772)	−0.3220 (0.0119)*	0.1864
	Deutsche mark	0.0750 (1.0298)	−0.1935 (0.0089)*	0.1288
	Japanese yen	1.7767 (0.9319)	−0.1766 (0.0098)*	0.0915
	Swiss franc	0.3498 (0.8272)	−0.1776 (0.0088)*	0.1133
	Eurodollar (nearby)	−3.2168 (1.9121)	−0.3189 (0.0129)*	0.1603
	Eurodollar (first)	0.6125 (1.9189)	−0.3669 (0.0170)*	0.1294
(3) Clearing Member	Pound sterling	0.4180 (0.8008)	−0.5698 (0.0136)*	0.3590
	Deutsche mark	−1.9235 (1.2823)	−0.7199 (0.0110)*	0.5727
	Japanese yen	−1.5254 (1.1966)	−0.7262 (0.0121)*	0.5308
	Swiss franc	0.2394 (1.0195)	−0.7267 (0.0107)*	0.5911
	Eurodollar (nearby)	9.4486 (2.3967)*	−0.4699 (0.0160)*	0.2172
	Eurodollar (first)	−0.6737 (2.4685)	−0.4968 (0.0196)*	0.1753
(4) Other Floor	Pound sterling	0.2636 (0.4674)	−0.0751 (0.0072)*	0.0356
	Deutsche mark	1.6799 (0.7889)*	−0.0584 (0.0065)*	0.0245
	Japanese yen	−0.4960 (0.7431)	−0.0615 (0.0069)	0.0244
	Swiss franc	−0.4190 (0.5589)	−0.0555 (0.0058)*	0.0282
	Eurodollar (nearby)	−0.4203 (1.3323)	−0.0928 (0.0080)*	0.0421
	Eurodollar (first)	−1.7433 (1.1540)	−0.0544 (0.0086)*	0.0134

Note.

$$\text{Model:} \quad L_{it} = \gamma_{0i} + \gamma_{1i} C_t + \varepsilon_t$$

L_{it} is the net trading, contracts bought minus contracts sold, for personal accounts, by the ith trader type in interval t, and C_t is the net trading by customers over the interval t. The model is estimated using weighted least squares, with the weight equal to 1000 times the inverse of total customer volume. The trader groups Local and All Dual are determined by the individual's trading during each day. The Clearing member regression has as a dependent variable the net trading by floor traders for their clearing members. The Other Floor group is net trading by floor traders for other floor traders. The sample period is from 11/1/90 through 4/30/91.

* A ratio of estimate to standard error greater than 2, indicating approximately 5% level of significance.

such as an order executed by a trader in a futures pit for an options local who is delta hedging or a local in another futures pit who is engaged in cross-commodity spreading.

The estimates of the γ_{1i}'s are negative and significantly different from zero for all groups across all commodities. In addition, due to the summing up of all imbalances to zero, the coefficients γ_{1i} sum to unity.[13] This result is consistent with the notion that each of these groups, including dual traders, tends to supply liquidity to the futures market with their personal

[13] These coefficients were found to be significantly different using a standard F Test.

TABLE IVB
LIQUIDITY PROVISION BY DUAL TRADER GROUP

Dual trader group (% personal volume)	Commodity	(1) γ_{0i} (SE)	(2) γ_{1i} (SE)	(3) Adj.-R^2
(1) Near-Local (more than 80%)	Pound sterling	−0.1229 (0.1783)	−0.0166 (0.0027)*	0.0180
	Deutsche mark	0.3514 (0.2861)	−0.0076 (0.0020)*	0.0062
	Japanese yen	0.2451 (0.5827)	−0.0431 (0.0052)*	0.0298
	Swiss franc	−0.3658 (0.3638)	−0.0150 (0.0035)*	0.0089
	Eurodollar (nearby)	2.0162 (1.2566)	−0.0430 (0.0058)*	0.0279
	Eurodollar (first)	0.8346 (1.0897)	−0.0352 (0.0071)*	0.0150
(2) Mixed (20 to 80%)	Pound sterling	−0.3225 (0.1826)	−0.0205 (0.0030)*	0.0150
	Deutsche mark	0.1625 (0.2747)	−0.0174 (0.0022)*	0.0217
	Japanese yen	0.0686 (0.2366)	−0.0029 (0.0019)	0.0011
	Swiss franc	0.0989 (0.3184)	−0.0263 (0.0031)*	0.0237
	Eurodollar (nearby)	6.9933 (1.2726)*	−0.0798 (0.0068)*	0.0469
	Eurodollar (first)	2.1472 (1.1676)	−0.0629 (0.0072)*	0.0304
(3) Near-Broker (less than 20%)	Pound sterling	−0.2427 (0.1057)*	−0.0091 (0.0017)*	0.0095
	Deutsche mark	0.1098 (0.2288)	−0.0079 (0.0017)*	0.0076
	Japanese yen	−0.2193 (0.1455)	−0.0042 (0.0013)*	0.0034
	Swiss franc	0.0816 (0.1636)	−0.0080 (0.0016)*	0.0077
	Eurodollar (nearby)	−3.8781 (0.7975)*	−0.0222 (0.0040)*	0.0111
	Eurodollar (first)	−0.5081 (0.7026)	−0.0208 (0.0043)*	0.0103

trading. While personal trading by all types of floor traders appears on average to contribute to market liquidity, the economic significance of this contribution differs across groups. This is particularly noticeable for clearing member accounts. These coefficients may be interpreted by considering a customer order imbalance of 100 contracts short in Deutsche marks. In such a situation, approximately 72 contracts will be bought by brokers for clearing member accounts, approximately 19 will be bought by locals, 3 by dual traders, and 6 by floor traders for other floor traders. In summary, the All Dual group contributes the least to market liquidity. Locals, on the other hand, are much more important in liquidity provision. The coefficients for Locals are approximately 2.5 to 8 times the size of comparable coefficients for All Dual. The most important liquidity providers, in terms of absorbing customer order imbalances, are clearing members. Since clearing member accounts typically represent less than 10% of futures volume, their trading appears to be concentrated during the periods of greatest liquidity demand.

Table IVB presents the results using the previously defined dual trader subgroups. Again, all coefficients are negative and significant, offering no evidence that any dual trader group mimics customer trading. All dual trader groups appear to supply liquidity to customer order imbalance. This is so even for Near Brokers who only execute a few personal trades and who are most likely to be trading on the basis of an informational advantage. There are only small differences between the coefficients for these three

TABLE IVC
LIQUIDITY PROVISION BY DUAL TRADING GROUP: PER-TRADER ANALYSIS

Trader group	Commodity	η_{0i} (SE)	η_{1i} (SE)	Adj.-R^2
Locals	Pound sterling	−2.549 (0.0476)*	−0.0067 (0.0008)*	0.0201
	Deutsche mark	0.1577 (0.0751)*	−0.0055 (0.0006)*	0.0251
	Japanese yen	0.0803 (0.1106)	−0.0073 (0.0010)*	0.0153
	Swiss franc	0.0750 (0.0794)	−0.0072 (0.0008)*	0.0231
	Eurodollar (nearby)	−4.9507 (0.4376)*	−0.0170 (0.0026)*	0.0134
	Eurodollar (first)	0.6571 (0.3170)*	−0.0158 (0.0023)*	0.0155
All Dual	Pound sterling	−0.0543 (0.0744)	−0.0320 (0.0013)*	0.1582
	Deutsche mark	−0.0388 (0.0434)	−0.0067 (0.0003)*	0.0905
	Japanese yen	−0.1610 (0.0562)*	−0.0079 (0.0006)*	0.0526
	Swiss franc	−0.0164 (0.0458)	−0.0089 (0.0005)*	0.0942
	Eurodollar (nearby)	−2.3255 (0.2581)*	−0.0158 (0.0017)*	0.0250
	Eurodollar (first)	−0.2435 (0.1950)	−0.0230 (0.0017)*	0.0535

Note.

$$\text{Model: } \frac{L_{it}}{N_{it}} = \eta_{0i} + \eta_{1i} C_t + \varepsilon_t^n,$$

where N_{it} is the number of members of group i trading for their own account in interval t.

groups, suggesting that dual traders' relative access to customer order flow has little relationship to their personal trading.

Table IVC presents the results when per-trader net inventory change is used as the dependent variable. For this analysis we use only the aggregate groups of Local and All Dual. The η_{1i} estimates are also negative and significantly different from zero for both groups. The hypothesis that coefficients for Locals and All Dual are the same cannot be rejected. These results reveal that, on a per-trader basis, dual traders and locals behave similarly relative to the customer order imbalance when they trade.

Together, these results support the hypothesis that dual traders are supplying liquidity with their personal trading. On an individual basis, dual traders' personal trading resembles that of Locals, who are generally considered to be acting as marketmakers. However, because on average there are many more Locals trading (as shown in Table I), their contribution toward liquidity provision tends to be significantly greater than dual traders'. These results reinforce the Section 3 findings regarding relative profitability. In terms of both personal trading strategy and per-contract profit, dual traders resemble marketmakers.

4. RULE 552 AND MARKET LIQUIDITY

In this section, we use the implementation of CME Rule 552 as a means of assessing the relationship of the dual trading market system to market liquidity. Grossman (1989) argues that "the elimination of dual trading will

TABLE V
CHANGES IN THE BID–ASK SPREAD

Commodity	Prerule average (obs.)	Postrule average (obs.)	Difference (*t*-statistic)
(1) Pound sterling	13.5130	10.0098	−3.5032
	(3149)	(3115)	(*−5.2256*)**
(2) Deutsche mark	9.3433	8.0365	−1.3068
	(3180)	(3137)	(*−3.3542*)**
(3) Japanese yen	9.7083	7.5235	−2.1848
	(3173)	(3092)	(*−4.6415*)**
(4) Swiss franc	11.1862	9.8876	−1.2985
	(3174)	(3126)	(*−2.3641*)**
(5) Lead Eurodollar	5.6530	5.6924	0.0395
	(2859)	(2589)	(*0.1479*)
(6) 2nd position Eurodollar	5.2489	4.9749	−0.2740
	(2666)	(2537)	(*−0.9161*)

Note. The bid–ask spread is the difference between the average price customers paid when buying from locals and the average price customers received when selling to locals during a 15-minute interval *t*. The prerule period is from 11/01/90 through 4/30/91, and the postrule period is from 6/10/91 through 11/30/91.

** Difference is significant at the 5% level.

decrease the number of brokers, decrease the number of marketmakers, and decrease market liquidity'' (p. 47). The above results lend further support to the notion that dual traders provide liquidity with their personal trading, suggesting that Rule 552 may lead to an increase in the liquidity premium, i.e., the bid–ask spread.

The restriction of dual trading may also decrease the adverse selection problem facing marketmakers. If some dual traders are at times mimicking their likely informed customers, as in the Fishman and Longstaff model, then risk-averse marketmakers will require a higher expected return in a dual trading system (see Sarkar, 1994). When dual trading is restricted, a reduction in this information premium may offset the liquidity effect associated with the reduced number of marketmakers.

To examine the effect of Rule 552 on liquidity, we calculate the bid–ask spread, S_t, by taking the difference between the average price at which customers buy from marketmakers and the average price at which customers sell to marketmakers. This is referred to by Stoll as the *realized* bid–ask spread. Table V presents pre- and postrule averages for the bid–ask spread in the six contracts. Note that for the four currency futures, the mean bid–ask spread is significantly smaller after the implementation of Rule 552 while for both Eurodollar contracts the change is not significant. Clearly, these results offer no immediate evidence of decreased liquidity due to

Rule 552 as the comparison is based on the unconditional change in the bid–ask spread.[14]

As summarized in Stoll (1989), microstructure models generally suggest that the bid–ask spread for an asset is a function of at least price risk, competition, the degree of asymmetric information, and volume. Risk-averse marketmakers will require premia associated with these factors in their expected return. Price risk is generally thought to have a positive effect on the bid–ask spread. Increased competition, with the number of traders making a market in the asset as a proxy, should lower the bid–ask spread. However, the relationship between volume and the spread is subject to debate. In the multi-pit futures environment, increased volume in a contract lowers average fixed costs (lease/contracts), which should lower the bid–ask spread. However, within a contract, volume may be a proxy for price or inventory shocks, and thus increased volume may lead to increases in the bid–ask spread. Prior research by Demsetz (1968) and Stoll (1978) incorporates these components in their empirical models of the bid–ask spread.

We test for the effect of Rule 552 on liquidity by employing a similar empirical model for the bid–ask spread, including an indicator variable for the period covered by Rule 552. Smith and Whaley (1994) and Jegadeesh and Subrahmanyam (1993) employ such an approach to investigate the effect of an event on the bid–ask spread. Specifically, our model is

$$S_t = \alpha_0 + \alpha_1 D_t + \alpha_2 STD_t + \alpha_{2b} STD_t * D_t + \alpha_3 VOL_t + \alpha_{3b} VOL_t * D_t + \alpha_4 N_t + \varepsilon_t^s, \tag{3}$$

where S_t is the bid–ask spread in the time interval t, STD_t is the standard deviation of price in interval t, N_t is the number of marketmakers trading in the interval, VOL_t is customer volume, and D_t is equal to 1 in the postrule period and 0 otherwise.[15] The standard deviation of price is calculated as the volume-weighted standard deviation of the bid, or the prices at which customers sold to marketmakers. This measure of intrinsic value volatility avoids contamination due to bid–ask bounce. If the bid is relatively constant in relation to the intrinsic value, then intrinsic value volatility will be mirrored in the bid volatility. Not surprisingly, using the ask for this purpose produces nearly identical results. The use of the variable N_t, the

[14] If volume and volatility were endogenous, the results in Table V would support the hypothesis of an increase in liquidity related to Rule 552.

[15] In the prerule period N_t includes locals and personal trading dual traders. The use of customer volume for VOL_t (the sum of long and short contracts) over the interval excludes an endogenous component, floor trader personal volume, which may be affected by Rule 552. Preliminary regressions led us to include dummy slope parameters for standard deviation and volume in Eq. (3).

number of active marketmakers, is suggested by Smith and Whaley (1994), although they did not obtain these data. The idea is that an increase in the number of marketmakers ought to decrease the bid–ask spread due to competitive pressure. For currency futures, these variables are measured over 15-minute intervals. However, due to the low volatility of the Eurodollar price relative to the minimum price change, hourly data were used.

We investigated several other specifications, particularly allowing for variations on volatility and volume. Substituting a lagged volatility measure, or using price range instead of the standard deviation of price, yielded very similar results. In addition, we used net trading by customers over an interval as a proxy for information flow. The use of this variable as a substitute or complement to volume also did not affect our results.

Results from the estimation of Eq. (3) are presented in Table VI. The standard errors reported in parentheses in Table VI are adjusted for autocorrelation and heteroskedasticity using the method of Newey and West (1987). First note that the results are consistent with prior analysis of the bid–ask spread. The coefficient on volatility, α_2, is significantly positive, with the exception of Eurodollars.[16] Also note that the spread is greater in periods with greater volume. The number of marketmakers is negatively correlated with the bid–ask spread, suggesting that increased competition lowers the bid–ask spread. The joint significance of the nonintercept terms, tested by the Wald χ^2 statistic in column 6 of Table VI, confirms the overall significance of the model.

The effect of Rule 552 on the bid–ask spread is captured by α_1. None of the point estimates are positive. Three of the six contracts yield negative values of α_1 which are significant at the 10% level. That is, comparing the results of Tables V and VI, the average value of the bid–ask spread in the four currencies is lower in the post-552 period, and for three of the four, we cannot reject the hypothesis that the fall in the bid–ask spread is related to changes in the other determinants of the bid–ask spread. More importantly, there is no evidence that the cessation of dual trading has led to an increase in the bid–ask spread in any of these markets.

While we find no evidence of a decline in liquidity following the implementation of Rule 552, there may be more obvious effects in the form of changes in marketmaker competition. In particular, the rule may lead directly to a decline in the number of traders trading for their own account. While some dual traders may choose to become full-time locals, the distribution of traders by activity presented in Table I suggests that most dual traders are likely to either switch to pure customer-order execution or quit trading the restricted contract altogether. To examine the loss in number of marketmakers due to Rule 552 we estimate

[16] There is little variability in Eurodollar volatility.

TABLE VI

RULE 552 AND THE BID–ASK SPREAD

Commodity	(1) α_0 (SE)	(2) α_1 (SE)	(3) α_2 (SE)	(4) α_{2b} (SE)	(5) α_3 (SE)	(6) α_{3b} (SE)	(7) α_4 (SE)	(8) Adj.-R^2	(9) χ^2 (p-value)
(1) Pound sterling	9.2516	−1.9324	0.2491	−0.0963	0.0074	0.0015	−0.5113	0.0853	156.79
	(1.3535)**	(1.5468)	(0.0489)**	(0.0566)*	(0.0018)**	(0.0020)	(0.0768)**		(<.001)
(2) Deutsche mark	5.4488	−1.8865	0.1195	0.0216	0.0011	0.0001	−0.0317	0.0530	122.24
	(0.7745)**	(1.0353)*	(0.0343)**	(0.0499)	(0.0004)**	(0.0005)	(0.0207)		(<.001)
(3) Japanese yen	6.2221	−1.4126	0.2057	0.0993	0.0028	−0.0015	−0.2196	0.0952	93.45
	(1.1113)**	(2.0365)	(0.0300)**	(0.1154)	(0.0006)**	(0.0010)	(0.0443)**		(<.001)
(4) Swiss franc	6.1959	−1.6696	0.1983	0.0496	0.0031	0.0003	−0.1840	0.0811	120.52
	(1.1724)**	(1.5732)	(0.0297)**	(0.0530)	(0.0008)**	(0.0010)	(0.0392)**		(<.001)
(5) Lead Eurodollar	5.2972	−1.5166	0.0264	0.1464	0.0005	−0.0003	−0.0456	0.0360	41.28
	(0.7116)**	(0.7623)*	(0.0620)	(0.0724)**	(0.0002)**	(0.0002)**	(0.0156)**		(<.001)
(6) 2nd position Eurodollar	4.9314	−1.4409	0.0562	0.1699	0.0004	−0.0004	−0.0422	0.0528	65.31
	(0.9420)**	(0.9579)*	(0.0860)	(0.0937)*	(0.0003)*	(0.0002)*	(0.0142)**		(<.001)

Note.

$$S_t = \alpha_0 + \alpha_1 D_t + \alpha_2 STD_t + \alpha_{2b} STD_t * D_t + \alpha_3 CUSTVOL_t + \alpha_{3b}\mathrm{CUSTVOL}_t D_t + \alpha_4 N_t + \varepsilon_t$$

S_t, the bid–ask spread, is the difference between the average price customers paid when buying from locals and the average price customers received when selling to locals during a 15-minute interval t, D_t is a dummy variable whose value is zero in the period preceding the CME's dual trading restrictions (Rule 552) and one in the period after the restrictions are in effect, STD_t is the standard deviation of the bid prices, $CUSTVOL_t$ is customer volume, N_t is the total number of floor traders who executed personal trades, and ε_t is a regression error with the usual properties. The model is estimated using OLS; the standard errors reported in the parenthesis are adjusted for autocorrelation and heteroskedasticity according to Newey and West (1987). The χ^2 tests whether the coefficients other than α_1 and α_2 are jointly significant.

** Roughly 5% significance.

* Roughly 10% significance.

$$N_t = \beta_0 + \beta_1 D_t + \beta_2 VOL_t + \beta_3 STD_t + \varepsilon_t^n, \quad (4)$$

where the variables are as defined above, and ε_t^n is a regression error with the usual properties. The value of β_1 is the average number of traders who ceased personal trading after the implementation of Rule 552, after controlling for other determinants (volume and price volatility) of the number of marketmakers. The results from the regression of Eq. (4) are presented in Table VII.

These results are consistent with intuition regarding the number of active marketmakers. Based on the significant estimates of β_2 and β_3, the number of active locals appears sensitive to customer volume and prior volatility, as expected. Increases in customer volume lead to an increase in the number of floor traders trading for their own account. Increases in volatility likely signal increases in profitable personal trading opportunities, and so likewise lead to an increase in the number of marketmakers. Our major concern is with the estimates of β_1, the effect of Rule 552 on the number of marketmakers. In all six cases the estimate of β_1 are significantly negative. Indeed, the estimates of the decline suggest a fall of 8 to 33% in the average number of active marketmakers directly attributable to the implementation of Rule 552, after taking account of changes in volume and volatility. The decline is consistent with the Grossman (1989) conjecture.

We use the value of β_1 as a point estimate of the change in the number of marketmakers due to Rule 552, and formulate a final test of the total effect of Rule 552 on the bid–ask spread. The quantity $\alpha_4\beta_1 + \alpha_1$ reflects the change in the bid–ask spread incorporating the direct effect on the number of marketmakers. The first term, $\alpha_4\beta_1$, attempts to capture the effect described by Grossman, where the bid–ask spread is expected to widen as the number of marketmakers decreases when dual trading is restricted. The second term is an effect independent of the number of marketmakers. The negative values reported in Table VI suggest that the elimination of dual trading lessens the marketmakers' informational risk.

In column 6 of Table VII we present these estimates and a test of the hypothesis $\alpha_4\beta_1 + \alpha_1 = 0$, using the variance/covariances of the α_i's from Table VI. While the point estimates of $\alpha_4\beta_1 + \alpha_1$ are lower in absolute value than α_1 alone, in no case is there a significant increase in the bid–ask spread associated with Rule 552. At the 5% level, both Eurodollar contracts experience a significant decline in the bid–ask spread. The decline in the Deutsche mark bid–ask spread remains significant at the 10% level. One interpretation of these results is that any reduction in marketmaker competition due to the elimination of dual trading may be insufficient to offset the information or other effects associated with a restriction on dual trading. Note that while all contracts experience a significant decline in the number

TABLE VII

RULE 552 AND THE NUMBER OF MARKET MAKERS

Commodity	(1) β_0 (SE)	(2) β_1 (SE)	(3) β_2 (SE)	(4) β_3 (SE)	(5) Adj.-R^2	(6) $\alpha_4\beta_1 + \alpha_1$ (t-statistic)
(1) Pound sterling	12.5853 (0.2515)**	−2.6914 (0.2359)**	0.0052 (0.0002)**	0.0415 (0.0049)**	0.4087	−0.5563 (−0.3497)
(2) Deutsche mark	25.9726 (0.7117)**	−1.5920 (0.5992)**	0.0060 (0.0002)**	0.1060 (0.0203)**	0.4431	−1.8360 (−1.7702)*
(3) Japanese yen	19.7878 (1.0377)**	−5.8873 (0.6374)**	0.0068 (0.0004)**	0.0813 (0.0315)**	0.4850	−0.1198 (−0.0587)
(4) Swiss franc	20.3990 (0.5083)**	−2.5443 (0.4854)**	0.0076 (0.0004)**	0.0857 (0.0096)**	0.4224	−1.2015 (−0.7789)
(5) Lead Eurodollar	25.4566 (1.7860)**	−8.9454 (2.0330)**	0.0061 (0.0004)**	−0.1483 (0.0508)**	0.6018	−1.1087 (−2.7573)**
(6) 2nd position Eurodollar	25.8694 (1.7943)**	−9.1124 (2.0075)**	0.0062 (0.0004)**	−0.1953 (0.0649)**	0.6050	−1.0564 (−2.0872)**

Note.

$$N_t = \beta_0 + \beta_1 D_t + \beta_2 CUSTVOL_t + \beta_3 STD_t + u_t$$

D_t is a dummy variable whose value is zero in the period preceding the CME's dual trading restrictions (Rule 552) and one in the period after the restrictions are in effect, STD_t is the standard deviation of the realized bid, $CUSTVOL_t$ is customer volume, N_t is the total number of floor traders who executed personal trades, and u_t is a regression error with the usual properties. The model is estimated using OLS; the standard errors reported in the parenthesis are adjusted for autocorrelation and heteroskedasticity according to Newey and West (1987).

** Roughly 5% significance.

* Roughly 10% significance.

of marketmakers (i.e., $\beta_1 < 0$), the sensitivity of the bid–ask spread to the number of marketmakers is relatively small (i.e., α_4 is near 0) for the three contracts that show significant change. As shown in Table I, these three contracts also have the highest average daily volume and largest number of locals. As a result, the marginal change in the bid–ask spread due to the loss of the personal trading of these dual traders is minimal.

Overall, the empirical analysis conducted here offers no evidence that Rule 552 has harmed liquidity in the four currencies or Eurodollar futures markets. While dual traders appear on average to provide liquidity to futures markets, the economic impact of this trading need not be significant in all markets, and may be offset by the effect of other dual trading strategies. Our results differ from Smith and Whaley (1994), who found that for the case of S&P 500 futures, their bid–ask spread estimator increased when the top step rule was implemented. Using the futures price time and sales data, the realized bid–ask spread estimator in Smith and Whaley (1994) is bounded below by the minimum price change. This institutional constraint leads to an upward bias in the estimator, as should be clear from the evidence presented here that marketmakers may earn less than the minimum price change on average.[17] Also, Smith and Whaley did not use the number of marketmakers as a control variable.

5. CONCLUSIONS

Dual trading was restricted on several contracts after May 20, 1991, by CME Rule 552. This study examines dual trading in these futures markets. We use approximately 1 year of intraday transactions data to analyze the effect of the implementation of the restrictions on these contracts. We examine the prevalence and performance of dual trading, dual trading strategies and outcomes, and the liquidity effect of the ban on dual trading.

We find that while in the prerule period a majority of customer trades in the commodities we analyze are handled by dual traders, dual traders account for only 20% of the total personal trading volume in these markets. We find some evidence that customers do better on days when their broker also trades for their own account, which is consistent with the hypothesis that dual traders have better customer order execution skills than pure brokers. While the above evidence is also consistent with the hypothesis

[17] Locke and Venkatesh (1995) test the application of the method of moments bid–ask spread estimator employed by Smith and Whaley on a broad array of futures contracts and find no relationship between this estimator and measured transactions costs.

that dual traders trade for their personal accounts when their informed customers place orders, we find no evidence of informational advantages in the personal trading of dual traders. The results also indicate that personal trading by exclusive personal traders and clearing member accounts forms the primary source of liquidity for these futures markets, although dual traders' personal trading also contributes to liquidity. On a per-trader basis, dual traders' liquidity provision appears similar to that of locals. Finally, we find no evidence that Rule 552 has decreased liquidity.

Our analysis is not an attempt to uncover improper trading by individual floor traders, but rather to analyze the relationship of dual trading to futures markets in general. Toward this end, our results indicate that as a group, dual traders do not profit abnormally when executing personal trades and seem to provide some market liquidity through absorbing customer order imbalances. However, while dual traders may supply liquidity with their personal trading, our evidence shows that a ban on dual trading in high volume markets such as those examined here need not have a significant impact on the bid–ask spread.

While we document no adverse effects on the liquidity of these contracts due to the dual trading ban, the effects of the ban on exchange members may not be trivial. Our results show that, before the ban, the average personal trading profits for all dual traders in all contracts were significantly positive. Thus, one direct effect of such a ban is an immediate elimination of an income source for dual traders. The extent to which dual traders have attempted to offset this loss through higher commisions is unknown. Moreover, our evidence also indicates that the ban was associated with a decline in the average number of active marketmakers who may have migrated to other pits. An assessment of the efficacy of the dual trading ban would take all these additional effects into consideration.

Dual trading remains controversial. Restrictions have the intended benefits of reducing the potential expropriation of certain customers' information and other trade practice violations. While the CME acted voluntarily to restrict dual trading in high-volume contracts, this same exchange appears to be in opposition to any proposals which would broaden the exchange's dual trading ban. We have no indication that other exchanges are considering dual trading restrictions. These actions seem to suggest that the above benefits are likely to be small when weighed against potential liquidity or restructuring costs.

The above conclusions need not apply to all futures contracts. The contracts we analyzed, selected for restriction by Rule 552, form some of the highest volume futures markets. The microstructure of these densely packed futures pits may not obtain in less populated pits or in a screen-based environment.

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