Does The Option to Cancel an Order in a Double Auction Market Matter?

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Abstract

The double auction trading environment has become one of the most experimentally-investigated trading environments. This paper seeks is to determine whether the ability of traders to cancel orders, before their potential execution, in a double auction framework, can affect price variables and the volume of orders and transactions. Not all researchers in the experimental markets literature allow that option. The vast majority of experimental markets researchers do not report whether they allowed that option or not. Because of the non-standardized use of the cancellation rule in the experimental-markets literature, presenting evidence on the possible effect of the cancellation option will be of interest to those conducting research in an experimental-market context.

Our results indicate that the option to cancel affects trading volume more than price-associated variables. We find that players use the option to cancel if the option is given to them. We also find that the number of submitted orders and the number of transactions is higher when we allow the players to cancel their orders. We present evidence that the obtained findings are not only due to budget constraints but also due to changes in the bidding behavior of the players. We do not find differences in the standard deviation of the limits of the standing submitted orders or in the price of the transactions.

Keywords: experimental markets, double auction, order cancellation

JEL Classification: C90, D40

1. Introduction

The double auction market is an institution in which buyers and sellers may continually make public bid/ask offers. This institution has long been favored in major financial markets[1], and experimental markets, because of its efficiency and simplicity (Friedman, 1991). Beginning with Vernon L. Smith's (1962) work, the double auction trading environment has become one of the most experimentally-investigated trading environments. Many researchers have used different manipulations to test its level of efficiency under various conditions. A major concern of any researcher is the ability to compare his or her results to the results obtained by others that used related, but different, manipulations. The purpose of this research is to determine whether the ability of traders to cancel orders, before their potential execution, in a double auction framework, can affect price variables and the volume of orders and transactions.

Although in practice major stock exchanges allow participants to cancel limit orders submitted to continuous trading systems (double auction environment) before execution, not all researchers in the experimental markets literature allow that option. The vast majority do not report whether they allowed that option or not. A few examples that demonstrate the variety of the use and the reporting practice of the cancellation option are: Smith, Williams, Bratton and Vannoni (1982) specifically indicate that a player can cancel orders. Mestelman and Welland (1995) do not report whether players can cancel orders although in practice they allow it.[2] Van Boening and Wilcox (1996) do not allow cancellation although their program allows that option.[3] Jamison and Plott (1997) do not allow cancellation of orders that meet the price improvement rule.[4] Kachelmeier, Limberg, and Schadewald (1991) put participants on the honor system whereby they were not allowed to cancel intentional bids and asks, but they were allowed to cancel inadvertent errors.[5] To our best knowledge, there is no documentation either theoretically or experimentally regarding the effect of the option to cancel standing orders (before execution) in a dual auction environment.[6] Because of the non-standardized use of the cancellation rule, presenting evidence on the possible effect of the cancellation option will be of interest to those conducting research in an experimental-market context.

Previous economic research investigated the effect of the right of one party to a contract to withdraw from it *after* he or she has been awarded it in a one-side auction framework.[7] Asker (2000) investigated, theoretically and experimentally, the effect of a cooling-off right on *buyer* behavior in a one-side auction environment. He documented that this right increases the revenue for the seller. Lengwiler (1998) and McAdams (1999) found theoretical evidence that the *seller* can change the supply in a one-sided auction after observing bids and their implications on the comparison between the discriminatory and uniform price auctions in a divisible unit framework. There is also research regarding the effect of the right of the buyer to withdraw a standing bid at a penalty in a one-side auction. Porter (1999) investigates this issue experimentally in the context of the Federal Communication Commission (FCC) auction. The experiments provided evidence that there is a tradeoff when traders are allowed to cancel--efficiency and revenue increase, but individual losses are larger.

Our contribution to the existing literature is in documenting that the option to cancel an order in a double auction environment can affect the obtained results. Our evidence indicates that it affects trading volume more than price-associated variables. We find that players use the option to cancel if the option is given to them. We also find that the number of submitted orders and the number of transactions is higher when we allow the players to cancel their orders. We present evidence that the obtained findings are not only due to budget constraints but also due to changes in the bidding behavior of the players. We do not find differences in the standard deviation of the limits of the standing submitted orders or in the price of the transactions.

Although the aim of the paper is mainly methodological, the results may also be related to questions that are related to financial markets. Although most exchanges allow cancellation in their continuous trading, some exchanges use different cancellation rules in their transparent call auction at the opening.[8] Given our results in the double auction environment, we expect a stronger volume results in a call auction environment. We leave this investigation for future research.

The paper continues as follows: In section two we describe the experimental design and procedure. Section three investigates the amount of the use of the option to cancel an order. In section four we investigate volume related variables--orders and transactions. Section five investigates price related variables and the effect on the payoffs of the players and section six concludes the paper.

2. Experimental Design and Procedures

The experimental design and procedures follow from Tuttle, Coller, and Plumlee (forthcoming) and are depicted in Table 1. The study's participants were engaged in a series of computerized, continuous double-auction asset markets where stock for twelve companies (see Table 1) was traded, one company per trading period. Traders were endowed with three shares of stock and 50 experimental dollars at the beginning of each trading period. The principal investigator (PI) informed them that they could use these resources to buy and/or sell shares. Traders also received a single printed sheet containing financial information (based on the actual financial statements of firms traded on the NYSE) for the company they were about to trade. Traders were assigned to two conditions in a between-subjects design. In one condition traders were told that they could cancel their bid/ask orders and were given instructions for the cancellation process. In the second condition traders were told that they could not cancel their bid/ask orders and the software features that allowed cancellation were disabled. Each trading period lasted three minutes. The market was then re-initialized, the printed sheet containing the financial information for the just-completed company was collected and a new sheet for the next company's trading period was distributed.

<<Insert Table 1 about here>>

Six traders participated in each of six market sessions (three in which cancellation was allowed and three in which cancellation was not allowed) which consisted of 12 independent three-minute trading periods.[9] During the trading period, contract, bid, and ask queues were projected on a large screen at the front of the room (see Figure 1). Bids

(asks) were presented from high to low (low to high) so that the highest bid and lowest ask were shown side-by-side at the top of two queues. Trader's available dollars and shares were displayed on his/her individual monitor (see Figure 2). The traders' seating was arranged so that they could not view other traders' screens. Written instructions for both conditions and a sample financial information sheet appear in the Appendix.

<<Insert Figures 1 and 2 about here>>

The initial three trading periods were practice and did not affect the traders' earnings. The initial periods allowed the traders to become familiar with the market process and the way the information related to the market exchange price. Liquidating dividends were shown on individual trading screens at the end of each practice period and were set equal to the NYSE exchange price for that company's stock for the year end from which the financial information was drawn. Beginning with the fourth period, the traders were informed that the remaining periods would affect their earnings and that liquidating dividends would no longer be disclosed at the end of the periods. The traders were told that the computer would record their earnings and that their earnings depended on how accurately they could forecast the company's liquidating dividend.

As can be seen from Table 1, cases were presented in one of three orders. Assignment to one of three orders and the two experimental conditions was randomized. At the conclusion of each session, the traders were paid 5% of the experimental dollars they had earned in cash. Average earnings were 694 experimental dollars per subject and each session lasted approximately 90 minutes.

Materials

Traders were provided with written instructions and twelve company data sheets. The data sheets were constructed from the financial statement information of companies as reported by Compustat and contained current-year and prior year financial highlights including: Current and Total Assets, Current and Total Liabilities, Sales, and Income Before Taxes. Several ratios calculated both for the company and an industry average

(i.e., Debt to Total Assets, Profit Margin, and Asset Turnover), and industry growth were included in the data sheets. The prior year's actual stock price, adjusted for stock splits and dividends, also was included. The companies were chosen from industrial and commercial machinery and computer equipment (SIC 3500-3599) and electronic and other electrical equipment and components (SIC 3600-3699). In order to minimize the likelihood that a subject might recognize one of the companies, data for 1988 and 1992 were used rather than for more recent years.

Subjects

Thirty-six undergraduate students (6 sessions with six traders in each) were recruited from courses in the business school at a large state university. Prior to participating in the experiment, the subjects were instructed about financial statement analysis in security valuation. When all experiment sessions were completed, the experimenters conducted debriefing sessions. At the debriefing session, subjects indicated that they enjoyed the experiments and took trading seriously. When asked, the subjects indicated that they could not recall specific company data from earlier periods when trading in the later periods during the experiment. Approximately 43% of the subjects indicated that they owned individual stocks or bonds.

3. Use of the Option to Cancel

The first question to ask given the nature of our manipulation is to what extent traders use their option to cancel orders. The average percent of cancellation, during the 36 rounds in which traders had that option (which consist of 3 different groups of traders), is 4.5% (t-value is 8.36) and the median is 3.8%. When we exclude the trial rounds (the first 3 rounds) the average is 4.2% (t-value is 6.77) and the median is 3.6%. Whether the trial rounds are included or not, the minimum percent of cancellation is zero and the maximum is 15.3%. As a result we conclude that the traders did not ignore but rather used the option to cancel orders if they had the option. Since the experiments are not internally independent we also present each of them in a separate graph

<<Insert Figure 3 about here>>

4. Volume Related Variables

After observing that the participants use the option to cancel orders, the next question to investigate is whether the use of the cancellation option affects the level of market activity. We divide this investigation into two sections, this section investigates the effect on volume submitted and transacted and the next section investigates the effect on the limit structure[10].

The Effect on the Number of the Standing Orders

We examined the standing orders (orders that eventually were not cancelled) between the two treatments. Since our variables are paired, we constructed the following variable:

Order Difference (hereafter OD) = (The number of standing order when allowing cancellation)$_{ti}$ – (The number of standing order when not allowing cancellation)$_{ti}$

Where:

i is the specific chosen order i = 1, 2, 3

t is the type of the specific traded share t =1-12

The mean of OD is 15.75 (including trial rounds). Which means that on average, for any given firm, the players submitted additional 15.75 standing orders when they had the option to cancel an order. The standard deviation is 9.32 and the t-value for differences from zero is 10.13. Not allowing cancellation causes significantly lower levels of order submission. The different distributions according to the three different orders is presented in Figure 4. Our results are robust to the exclusion of the trial rounds.

<<Insert Figure 4 about here>>

For robustness checks we also conduct the non-parametric Wilcoxon Rank Test and the non-parametric Sign Test for the level of transactions when traders were allowed to cancel orders or not. We investigated the two samples with and without the trial rounds. When we include the trial rounds the Z values are –5.2 and – 5.8 respectively. Our results are robust to the exclusion of the trial rounds[11]

Our conjectures to the obtained results are both technical, strategic and behavioral:

1. Technical–it is more likely that traders will face higher budget constraints when they cannot cancel orders compared to the case where they can cancel an order.
2. Strategic–when cancellation is possible, traders may use some of their orders to communicate or engage in strategic activity.[12]
3. Risk and loss aversion- it is more likely that risk and loss aversion will play a stronger role in the case where cancellation is not available.

Obviously the different conjectures have different implications on the suggested methodology to use in experiments. If it is only the technical component that creates our findings, then as long as the researcher creates an experiment with minimum budgets constraints to the players, he or she should not be worried about the cancellation option. However, if there is an additional component of strategic playing or if additional behavioral effects exist only in one treatment, reducing the budget constrains will not eliminate the differences. Hence, presenting evidence indicating that the results are not only driven from technical constraints is of interest. In order to test the effect of the technical component of our conjectures we examine the differences between buy orders in cases where the players may have different magnitudes of budget constraints. A player can buy as many shares as he/she wishes up to $50 (unless they earn additional money). If the technical explanation is dominant, our expectation is to find higher effect of the ability to cancel in higher priced shares where the budget constraint is more effective than in low price shares when the budget constraint is less effective.

In order to test our expectation we calculated the number of the buy orders and the average submitted price in each round in each experiment. We calculated the Pearson, Kendall's tau and Spearman's rho Correlations. As we expected in all three estimations the correlation is positive. However, none of the correlations is statistically significant ($p=0.12$, 0.12 and 0.13 respectively). The higher the average limit the higher is the impact of the ability to cancel orders (0.26, 0.19, and 0.26 respectively). This may be evidence that another in addition to technical constraints may affect the reported results.

The Effect on the Number of Transactions

Since the observation of higher level of orders does not necessarily imply higher level of transactions, we also investigate that. Given our orders results, we expected to see significantly more transactions when we allowed cancellation. Again since our data is paired, we constructed the following variable:

Transaction Difference (hereafter TD) = (The number of transactions when allowing cancellation)$_{ti}$ – (The number of transactions when not allowing cancellation)$_{ti}$

Where:
i is the specific chosen order i = 1, 2, 3
t is the type of the specific traded share t = 1-12

The mean of TD is 2.33 (including trial rounds). Which means that on average for any given firm there were an additional 2.33 transactions when the players had the option to cancel an order. The standard deviation is 2.87 and the t-value for differences from zero is 4.86. Not allowing cancellation causes significantly lower levels of transactions. The different distributions according to the three different orders are presented in Figure 5. Our results are robust to the exclusion of the trial rounds.[13]

<<Insert Figure 5 about here>>

For robustness checks we again conduct the non-parametric Wilcoxon Rank Test and the non-parametric Sign Test for the number of transactions when players were allowed to cancel orders or not. When we include the trial rounds the Z values are –3.89 and – 3.95 respectively. Our results are robust to the exclusion of the trial rounds.[14]

Although we find that the number of orders and transactions is statistically higher when we allow cancellation, we also find that the ratio (transaction/standing orders) is slightly lower and statistically significant when we allow cancellation. On average, when we

include trial rounds, 22% of the standing orders transacted (median is 23%) when we do not allow cancellation compare with 20% (median is 21%) when we allow cancellation. When we exclude the trial rounds the difference is stronger. We find 23% of the standing orders transacted when we do not allow cancellation (median is 23% as well) compare with 19% (median 18%) when we allow cancellation. Although the paired t test is not statistically significant different from zero (t= -1.16) when we include the trial rounds, it is statistically significant when we exclude the trial rounds (t=-3.11). Moreover, the non parametric tests; the Wilcoxon Signed Ranks Test , and the Sign Test indicate significant differences at 7% level (p=0.06, 0.07 respectively) when we include the trial rounds and indicate significant at 2% level when we exclude the trial rounds (p=0.01, 0.02 respectively). These results are consistent with our conjecture that it is not only the relaxation of the budget constraint that is driving the obtained results. One potential additional explanation is manipulation that resulted in more orders when the option of cancellation exists. Another potential explanation is risk aversion or loss aversion that can reduce the number of submitted orders when the cancellation option does not available.

5. Price related variables

The Effect on the Variation of the Limits Submitted

Given the fact that we find differences in the amount of standing orders it of interest to learn whether there is also difference in the limit structures. We calculated the standard deviation (STD) of the orders submitted in each experiment in each round. When we include the trial rounds, the mean of the standard deviation when allowing cancellation is 2.70 the mean of the standard deviation when disallowing cancellation is 2.80. The median of the standard deviation when allowing cancellation is 1.66 and the median when disallowing cancellation is 1.27. The results obtained from comparing the averages and the median are contradictory, which suggest that there is no statistical difference between the standard variation of the limit under both treatments.

Again, since our observations are paired we constructed the following variable:

STD Difference (hereafter STDD) = (The std of limits when allowing cancellation)$_{ti}$ – (The std of limits when not allowing cancellation)$_{ti}$

Where:

i is the specific chosen order i = 1, 2, 3

t is the type of the specific traded share t = 1-12

The mean of STDD -0.097 which is not statistically significant than zero (t value of – 0.105). For robustness checks we also conduct non parametric tests and we also find non significance when we perform the Wilcoxon Signed Ranks Test (Z = -0.42) and the Sign Test (Z = -0.17). Our results are similar when we exclude the trial rounds[15] and we conclude that we cannot report a difference in the variation of the limits that are submitted when we allow cancellation compared to disallowing cancellation.

The Effect on the Variation of the Transaction' Prices

Variation of transaction is a common measure of liquidity in the empirical financial literature. When we include the trial rounds, the mean of the standard deviation of the transactions' prices when we allow cancellation is 0.88 compared with 0.86 when we do not allow cancellation. The median of the standard deviation of the transactions' price is 0.67 compare with 0.32 when we disallow cancellation.

When we conducted a t-test for the differences between the standard variations we find that the difference is not statistically significant from zero (t = 0.059). We also find no significance when we perform the Wilcoxon Signed Ranks Test (Z =-1.29) and the Sign Test (Z= -1.5). Our results do not change when we exclude the trial rounds.[16]

Do Investors' Profits Change?

The mean of the salary under the two different treatments is very close 694.00 when we allow cancellation and 693.99 when we do not allow cancellation. The fact that it is relatively close should not be surprising since for any given trade it is zero sum game.

However, for the total players, it is not a perfect zero sum game since a player can earn money on orders that were not executed.

Since the average is not a good point estimator for understanding the interaction in the game regarding the salary obtained by the players, our focus in this section is the distribution of the payoffs and the variance of the payoffs under the two different treatments.

When we examine the distribution of the payoff we find that there is higher variation of profit when investors can cancel orders. Since the traders are compensated for the difference between their transaction to the actual price for that specific share in the market. Higher variation means less accuracy. Given the relatively small size of our sample (18 players in each manipulation) the difference in the variance is not statistically different using the F test. However it is still interesting to observe that when we did not allow cancellation the transactions were closer to the "true" price.

6. Conclusion

We documented in this paper that the cancellation option has an effect on the obtained results of an experimental double auction environment. In order to improve the comparison of research results, we recommend that future researchers report whether participants were given the option to cancel orders. Since we had no theory to test, the focus of the paper is descriptive. We find differences in the quantity of orders submitted and executed and we do not find differences in the limit structure. We leave the investigation of additional efficiency measurements that cannot be investigated under this particular experimental design for future work. We leave as an open question for future research the investigation of more detail investigation of the causes for the documented differences. Last but not least, given our results in the double auction environment, we expect a stronger volume results in a call auction environment, since we expect stronger effects of reduce risk aversion and ability of manipulation. We leave this issue for future investigation.

Appendix -- Instructions and Sample Data Sheet
Instructions—cancellation allowed condition (no cancellation allowed)

You are about to participate in a real market where you will trade shares of stock in different companies. As in any market, you should pay close attention to all the information you receive because you will be paid an actual percentage of your profits in CASH at the conclusion of the experiment.

Several rounds of trading will be conducted. Before trading begins in each round, you will be given information about the company whose stock you are trading. These data are based on real companies in real industries except that some data have been modified to accommodate the exercise. You should use this data to determine the market price at which you are willing to buy or sell the stock for that particular company.

During trading, you can earn profits in two ways: through (1) dividends and (2) trades.

Dividends. At the conclusion of trade for each round, the company will buy back any shares you own. This is called a "liquidating" dividend. You will be paid the actual price at which the company's stock was traded on the NYSE during the time frame corresponding to the information you receive about the company. Therefore you earn more profits by buying for less or selling for more than the liquidating dividend amount.

Trades. At the beginning of each trading period, you will receive 50 experimental dollars (S40 of which is an interest-free loan and S10 of which you keep towards your cash earnings) and three shares of stock. You may sell some or all of these shares, or hold them and collect the dividend. You may also buy additional shares and hold them to collect the dividend. Or, you may also sell any additional shares that you have purchased. Any money you earn from selling shares above their purchase cost contributes to your profits.

Cash Payment. The computer will keep track of your performance for you. At the end of the first several rounds, the computer will display performance information for the round just completed. At the conclusion of the entire experiment, the computer will report your total accumulated earnings and you will be paid 5.00 U.S. dollars for each 100 experimental dollars you have earned.

(Appendix continued)

How to make Trades in the Market. You can both buy and sell shares of stock by posting *Bids-to-Buy* and *Offers-to-Sell*. Offers and bids are posted by entering a non-zero amount in the "Offer" box or "Bid" box and then either pressing the TAB key or clicking on the other box. You can withdraw your offer or bid by entering a zero amount. (Once you post an offer or bid, you cannot post another until the original offer or bid is accepted by another trader.)

At intervals, the trading board polls the offers and bids that have been submitted and determines if a trade has occurred. A trade occurs when an offer-to-sell exists that is lower than or equal to a bid-to-buy. At this point, the offer and bid are removed from the queues, a new contract is posted, and the traders' dollars and shares are adjusted.

First Three Companies. The first three companies are for practice only and will not affect your cash earnings. After trading in these three companies, you will then trade using information for companies that will affect your cash earnings. You should consider each trading period to be independent. Therefore, each company is like starting over and you will be re-endowed with money and shares.

On the following pages, you will see the company information that you will use to base your market decisions:

- last year's stock price on the date last year's financial statements were issued
- last year's financial data
- current year's financial data
- key indicators for the firm and its industry.

You should use all of this information to estimate the current year market price.

All company data are from the late 1980's or early 1990's and pertain to one of two manufacturing industries: industrial and commercial machinery and computer equipment; or electronic and other electrical equipment and components. We have included companies for which this limited amount of financial information can be used to estimate an accurate stock price. However, the sample, as a whole, does not reflect the mix of firms in the actual stock market.

(Appendix continued)

(Note: This is an example of the financial information available to traders during each of the trading periods)

Company A

Company Financial Data	**Current Year** Thousands of Dollars	Prior Year Thousands of Dollars
Balance Sheet Figures		
Current Assets	**$ 89,983**	$ 62,742
Total Assets	**103,318**	73,580
Current Liabilities	**49,853**	22,976
Total Liabilities	**60,872**	34,956
Income Statement Figures		
Sales	**$ 188,318**	$ 153,346
Income Before Taxes	**5,385**	6,530
Closing Stock Price (in dollars)	**?**	$ 14.50

Key Indicators	Company A Current Year	Industry Average
Projected Industry Growth	N/A	+ 31 %
Debt to Total Assets Ratio (Total Liabilities divided by Total Assets)	58.9 %	43.0 %
Profit Margin Ratio (Income before Taxes divided by Sales)	2.9 %	2.4 %
Asset Turnover Ratio (Sales divided by Total Assets)	1.82	1.34

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Notes

[1] For instance, stock markets, money markets for U.S. funds, commodities markets, and foreign exchanges.
[2] Confirmed that with Stuart Mestelman
[3] Confirmed with Mark Van Boeing.
[4] Confirmed with Charles Plott.
[5] Confirmed with Steven Kachelmeier.
[6] We refer to a dual auction environment, as an auction that involves multiple buyers and sellers where each player can be both a buyer and a seller.
[7] We refer to one-side auction as an auction with one seller and many buyers or an auction with one buyer and many sellers. In these auctions each player is either a buyer or a seller but cannot act as both.
[8] For example, the Tel-Aviv Stock Exchange, during 1998, allowed cancellation of orders in the first hour and fifteen minutes of its pre-opening stage but did not allow cancellation in the last fifteen minutes of the pre-opening stage.
[9] Smith (1982) argues that convergence to competitive equilibrium occurs with six traders and that the double auction exhibits strong competitive equilibrium properties. Lundholm (1991) demonstrates that double auctions with six traders converge to the efficient price much more quickly than do markets with 12 traders. The number of periods was determined at 12 to allow sufficient practice.
[10] We do not discuss convergence in this paper because there is no well-specified supply/demand curve and no well-specified theoretical equilibrium due to the experimental design.
[11] The Z value for the Wilcoxon Signed Test is -4.54 and the Z value for the Sign Test is –5.
[12] The ability to manipulate financial markets and what affect these potential manipulations is of a long time concern of researchers and practitioners. For an historical survey see Allen and Gale (1992). We are not the first to conjecture the relation between the ability to cancel an order and possibility of manipulations in asset markets. Camerer (1998) uses the option to cancel an order in order to investigate whether racetrack betting can be manipulated. The net effect of the manipulation in his field experiment was close to zero and insignificant.
[13] The t statistics when we exclude the trial rounds is 3.60
[14] The Z test for the Wilcoxon Signed test is –3.01 (Asymptotic sig. 0.003)
[15] The Wilcoxon Signed Ranks Test (Z=-0.77) the Sign Test (Z= -0.77) and the t test (t= 0.016) are all non-significant at commonly used levels of confidence.
[16] The Wilcoxon Signed Ranks Test (Z=-1.39) the Sign Test (Z= -1.54) and the t test (t= 0.35) are all non-significant at commonly used levels of confidence

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TABLE 1
Experimental Design and Procedures
6 sessions; 3 orders
36 traders; 6 traders per session

Procedure

Instruct and Obtain Informed Consent	**Order 2 Company**	**Order 2 Company**	**Order 3 Company**
Period 1 Practice	A	A	A
Period 2 Practice	B	B	B
Period 3 Practice	C	C	C
Period 4 No-error	D	E	F
Period 5 No-error	E	F	D
Period 6 No-error	F	D	E
Period 7 Filler	G	G	G
Period 8 Material 3x	D	E	F
Period 9 Immaterial Liberal	E	F	D
Period 10 Material 5x	F	D	E
Period 11 Immaterial Conservative	D	E	F
Period 12 End of Session	H	H	H
Pay Participants			
Debrief Participants			

Note: Sessions were randomly assigned to a version within each order.

TABLE 2
Calculation of materiality manipulation for Companies D, E, and F
(Thousands of Dollars)

	Company D	E	F
Method 1:			
Income before Taxes	253	911	6,849
Times 10 percent	x .10	x .10	x .10
Liberal materiality based on Pretax Income	25	91	685
Method 2:			
Net Sales	34,097	7,009	148,590
Times 0.5 percent	x .005	x .005	x .005
Liberal materiality based on Net Sales	170	35	743
Liberal materiality (greater of method 1 or 2)	170	91	743
Conservative materiality (i.e., greater of 5% Income or 0.25% Sales)	85	46	372
Material 3x: 3 times liberal threshold	510	273	2,229
Material 5x: 5 times liberal threshold	750	455	3,715

Figure 1. Market activity screen (projected on a large screen viewed by all participants.

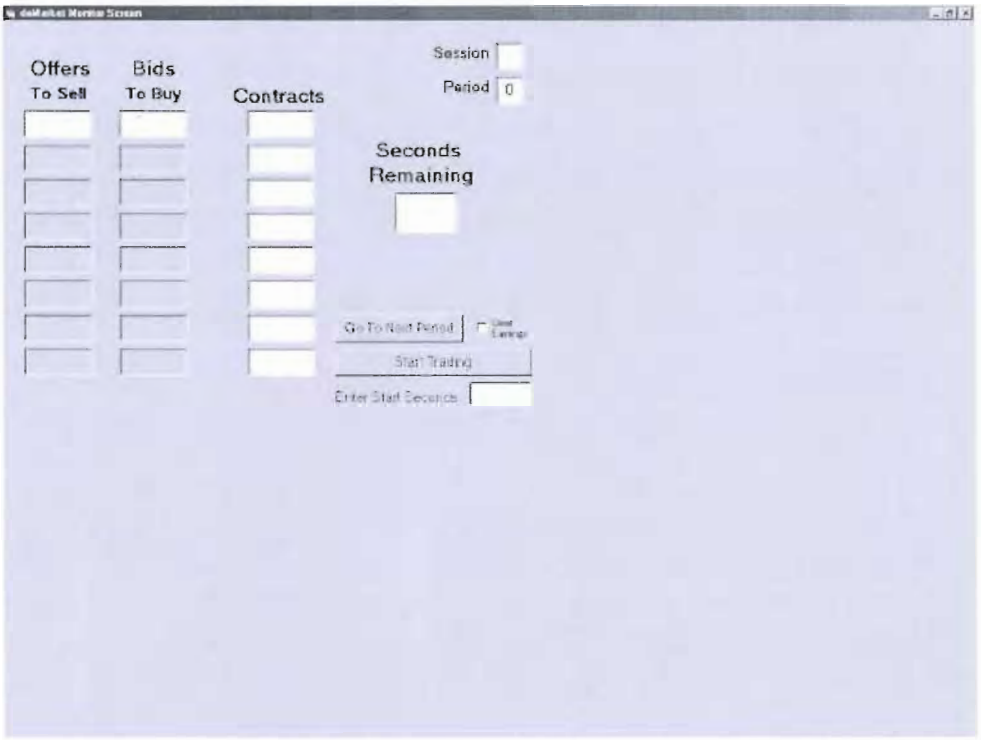

Figure 2. An individual trader's screen.

Figure 4. The distribution of the number of standing orders.

Figure 5. The distribution of the number of transactions.

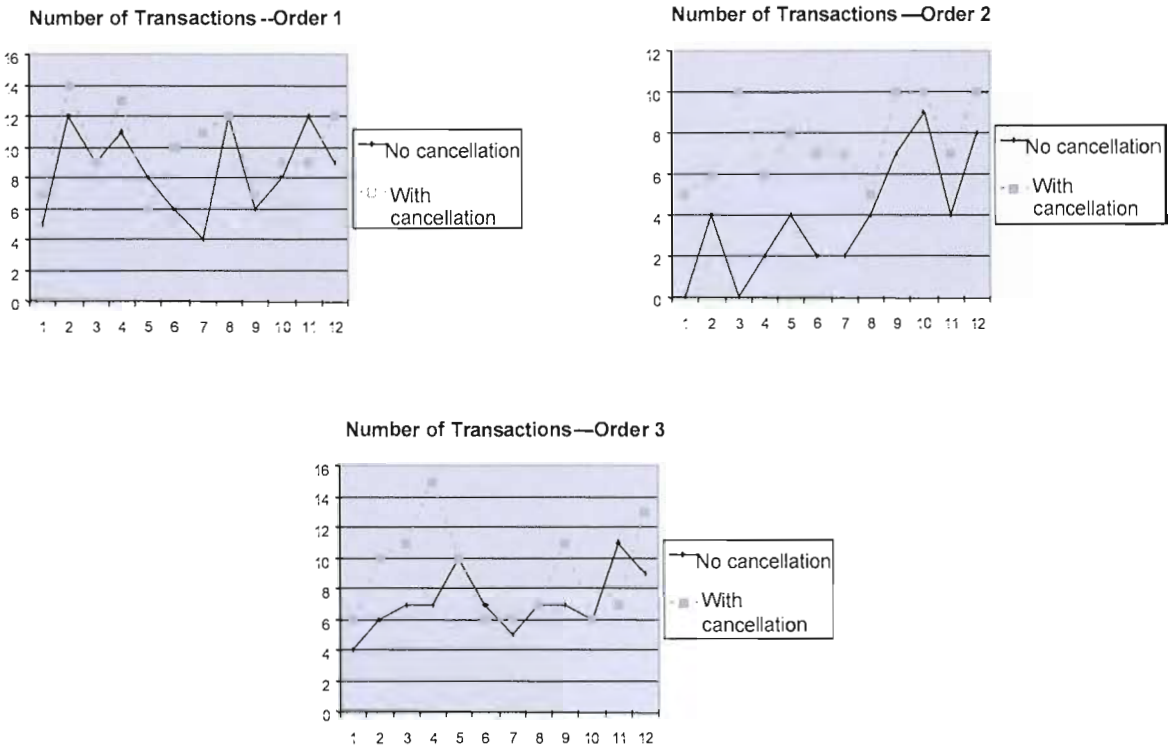

Figure 3. The percentage of cancelled orders in the different experiments.