FTS Market Microstructure Treatments
Including
Quote and Order Driven Markets

FTS supports the following market microstructures:

- The continuous double auction (default setting for most cases)
    - All traders can make market (submit bids and asks) and take market (hit bids or asks submitted by others)
    - Every trader sees all the bids and asks posted
        - Though the moderator can hide this or make this visible for everyone from the Microstructure menu item; if it is hidden, then only the best bid-ask is shown
- A call market
    - This is initiated from the Microstructure menu item
    - In this market, everyone can submit bids and asks. At the end of the period, if there are crossing bids and asks, these are crossed at a single price that maximizes the volume of trade. If there is an interval of prices that maximize the trading volume, the average of that interval is chosen (so the surplus is split between the buyers and sellers)
- A pre-opening call market
    - This is the same as the call market, except that at the end of the call market trading, the uncrossed bids and asks remain in the system for the start of the trading in a double auction
- A pure order driven market
    - In this market, every trader can submit an offer or buy and/or an offer to sell. These are shown in a limit order book visible to everyone; the highest buy offer and the lowest sell offer are also shown to everyone.
        - The moderator can hide these, as above, though the best offers are still shown.
    - Trade takes place when a bid comes in that exceeds an existing ask (at the existing ask) or when an ask comes in that is less than an existing bid (at the existing bid).
    - The has to be set in the case spreadsheet
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- A pure quote driven market
    - In this market, there is a distinction between market makers and markets takers.
        - Only market makers can submit quotes (bids/asks)
        - Market takers can submit buy and sell orders
        - The buy and sell orders are visible to the market makers only
        - The best quotes are visible to everyone
        - Market makers can fill orders by double clicking on the order in the book
            - But these have to satisfy price and time priority
        - The market makers/takers have to be specified in the case spreadsheet
- Other microstructure variations
    - Privately negotiated trades
        - In any of the treatments above, you can also allow privately negotiated trades. In this setting, trader 1 privately sends a message to trader 2 suggesting a trade. If trader 2 accepts, the trade is executed and reported to all traders.
        - This has to be set in the case spreadsheet
    - Block trades
        - A trader can be given a short or long position in a security, and be required to trade out of that position before they can trade it for their own account.
        - If they do not trade out of that position, they do not earn any payoff in that security

▪ This has to be set in the case spreadsheet

Details and Examples

The following examples use Case RE1_1 which is the 1-stock version of RE1. All the variations below are in the case spreadsheet titled Market Efficiency Cases (ftsStdRE.xls).

The main microstructure treatments are implemented in the case spreadsheet and are in the "trader type" data in the case spreadsheet. This data starts in Column A Row 20. It is shown for the different microstructure treatments below.

RE1_1: Double Auction

Trader Data	Type 1	Type 2
Cash	2000	2000
Endow 1	100	100
Rights 1	0	0

This case has two trader types. The first type starts with 2000 in cash and an initial position (endowment) of 100 of the first security. The row titled "Right 1" controls the trading rights of trader type 1. It is set to 0, which means the trader can submit bids and asks ("make market"), and accept bids and asks made by others ("take market"). The possible values are:

0 = No restrictions on market making or market taking
1 = Market making rights only (i.e., can only bid to buy or ask to sell),
2 = Market taking rights only (can only buy from ask or sell to bid)
3 = No trading rights in the security (permits creating a non tradable position).
4 = Bid rights only
5 = Ask rights only
6 = Buy rights only
7 = Sell rights only
8 = Buying rights only (Bid + Buy)
9 = Selling rights only (Ask + Sell)

So even within the double auction, you can restrict market making and market taking activity by changing these numbers. The maximum number of traders and the number of trader types determines exactly how many traders of each type there actually are within the system. For example, if the maximum number of traders is 60 and the number of trader types is 2, then the system will create 30 type-1 traders and 30 type-2 traders. The first student to log in will be type 1; the second will be type 2, the third type 1, and so on. If the maximum number of traders is 60 and you have 7 trader types, the system will create 8 types of each trader and 4 additional type 1 traders (7*8+4=60). The first, 8th, 15th,… will be type 1. The maximum number of traders is specified in cell B5 of the spreadsheet and you also have to specify the number of trader types below this in cell B6:

Maximum Number of Traders	60
Number of Trader Types	2

Note that in student markets, if you have too few market makers and they don't submit bids and asks, there will be no liquidity. For this reason, the default setting in most FTS cases is to set the trading rights of every trader type at 0, which allows everyone to bid and ask.

In a double auction, trading takes place as follows:

- A market maker submits a bid from the trading area at the top right by typing in a price and a quantity, and clicking "Submit Bid". This is shown to everyone. If market taker hits the bid (clicks "Sell to Bid"), the market maker buys and the market taker sells.
- A market maker submits an ask by typing in a price and quantity and clicking "Submit Ask." This is shown to everyone. If market taker hits the ask (clicks "Buy at Ask"), the market maker sells and the market taker buys.
- If a bid exceeds the ask, the two are crossed by the system at the price that existed first (so if a bid was submitted prior to the ask, the cross takes place at the bid price).
- The outstanding bids and asks are shown to everyone, e.g.

Bid	Bid Qty	Bid ID		Ask	Ask Qty	Ask ID
95.20	9,210	Trader 75		95.80	900	Trader 57
95.10	9,900	Trader 75		95.90	290	Trader 64
95.00	290	pTrader1		96.90	720	Trader 57
94.10	100	Trader 14		97.00	400	Trader 20
94.00	100	Trader 35		99.99	500	Trader 73
92.00	10,000	Trader 42		104.00	20,000	Trader 47
92.00	1,000	Trader 56				
91.30	100	Trader 14				
91.20	100	Trader 14				

- Bids can be raised, and asks lowered, by typing in the entries and submitting either the bid or the ask, or by using the hand signals. Similarly, you can Sell to Bid or Buy at Ask with the hand signals:

95.20/9,210				95.80/900			
78.00/19,700				90.90/975			
77.90/80				78.40/7,780			

- The hand pointing up raises the bid, the first hand pointing right sells, the hand pointing down lowers the ask, and the first hand pointing left buys at the ask (the second hand (with the little red writing on it) buys or sells on margin if the case allows it).

RE1_1_B: Block Trades

The trader type part of the spreadsheet is:

Trader Data	Type 1	Type 2	Type 3
Cash	2000	2000	1000
Endow 1	100	100	200
Rights 1	0	0	10

You can see that the third trader type has rights for the first security set at 10. This means that they first need to sell their initial endowment/position of 200 units of the first security before they can do anything else. So this trader will not be able to submit a bid or hit an ask until the 200 units have been sold.

The maximum number of traders and number of trader types is specified in cells B5 and B6:

Maximum Number of Traders	60
Number of Trader Types	3

This means that there will be 20 traders of each type.

If a type 3 trader tries to submit a bid or hit an ask, the trader will receive the following message:
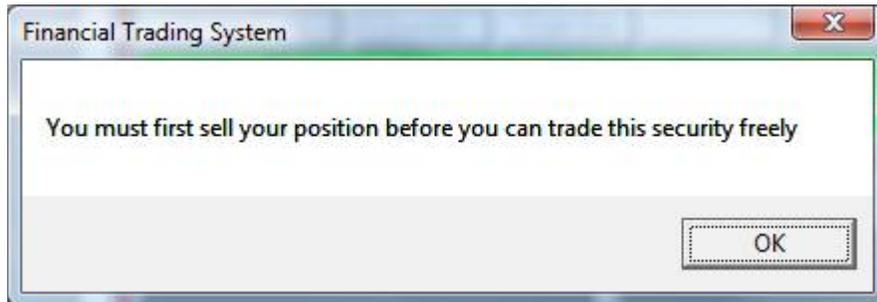
After the 200 units have been sold, they are free to trade normaly.

RE1_1_O: Order Driven Market

Case RE1_1_O has the following data:

Trader Data	Type 1	Type 2	Type 3
Cash	2000	2000	2000
Endow 1	100	100	100
Trading Rights	1	1	1

The trading rights mean that everyone can only submit bids and asks. The trading area looks like this:

You can see that the "Sell to Bid" and "Buy at Ask" buttons are disabled. In this market, trade takes place when a bid crosses with an ask. In essence, what happens is that a bid is interpreted as a buy order and an ask is interpreted as a sell order. All these orders are displayed in the book, and trade takes place when there is a cross.

RE1_1_Q: Quote Driven Market

This is the most complex but also most realistic setting. There are specific market makers and market takers, but the market maker has additional ability to fill orders. The case information looks as follows:

Maximum Number of Traders	60		
Number of Trader Types	11		
Trader Data	Type MM	Type 1	Type 2
Cash	3000	2000	2000
Endow 1	0	100	100
Trading Rights	101	102	102

Types 3-10 are identical to types 1 and 2. With 60 traders in all, this means there are 6 traders of Type MM with trading rights set at 101 and 54 traders with trading rights set at 102. "MM" obviously stands for "market maker."

The market makers are the only ones allowed to post quotes (bids and asks). The market takers can see the best bid or ask submitted by the market makers and they can see their own orders; they can also submit buy or sell orders. The trading area for market takers then looks as follows:

For the market maker, the trade area lets them enter bids and asks normally:

Everyone sees the best bid-ask posted by the market makers. The market makers also see the buy and sell orders. If a market maker wants to fill an order, they simply double click it to fill it:

Buy Price	Buy Qty	Buy ID
12.25	15	trader1

Note: in the book menu, a trader has the option of seeing the entire book or just their own book (i.e. the bids and asks they have submitted). When viewing their own book, double clicking on an entry clears that bid or ask. A market maker sees the buy and sells orders, and fills an order by double clicking on it.

Trading targets: Another variation is to specify a trading target. Here, the trading type is specified at e.g. 101/75/20. This is interpreted as: this is type 101 (as above), and they have to end the trading trial with 75 units of the security. If they end up with N units, they are charged a penalty equal to $20*ABS(75-N)$.

Pure market makers: You may want to run a treatment where a market maker has the incentive to provide liquidity. A type 201 is identical to type 101 except that they do not receive any payoffs from any security. Therefore, their final cash comes entirely from trading. So if they do not provide any liquidity, there is no profit. Note that simply positing bids and asks in not enough; to make money, they need to post bids and asks at which otgher traders are willing to trade.

Other Variations

You can also set other trading limits by editing the case spreadsheet before running the case. The case template has the following fields. The area in light green applies to everything; the area in light yellow is security specific.

Number of Securities	1	Name	ABC	
Maximum Number of Trials	8	Security Type	Stock	
Number of Periods per Trial	2	Price Quotes	Endogenous	
Period Length (seconds)	300	Start Life		1
Maximum Number of Traders	60	End Life		2
Number of Trader Types	2	Short selling	Yes	
Market Depth	10	Quote to Price Formula	Quote	
Depth Displayed	5	Information	Yes	
Borrowing Allowed	Yes/No			
Last Row with Exogenous Prices		Magintrade	No	
Number of Information Types	9			
Last Row with Information	36			
		Private Trade	No	
		Max Qty (type specific)	5000/5000	
		Price Bounds	0,50	

In the light green part, borrowing is type specific. So in the example shown here, trader type 1 is allowed to borrow, trader type 2 is not.

In the light yellow part, you can set private trades to yes to allow students to negotiate prices directly without it being shown to anyone else; if they do trade privately, the trade is reported to everyone.

The Max Qty set the maximum quantity per trade. This is also type-specific.

Finally, you can set price bounds; as shown, the minimum quote is zero and the maximum quote is 50.

Private Trades

If you permit private trades, the "Private Trade" button in the trade area becomes enabled:

Clicking it brings up the following window, where we have entered some data:

On the left, you see the list of traders and their ID's. We are asking trader2 if they would be willing to buy 15 units of security 1 at the price of 12 each. Once the Submit button is clicked, trader2 sees the following:

They can now accept or reject the trade. If accepted, it is shown to everyone in the Last column of every trader:

The trader who initiated the trade is told of the acceptance or rejection of the offer.

Call Markets

You can convert a double auction to a call market *prior to the start of a trading period* from the Microstructure menu item of the FTS Market:
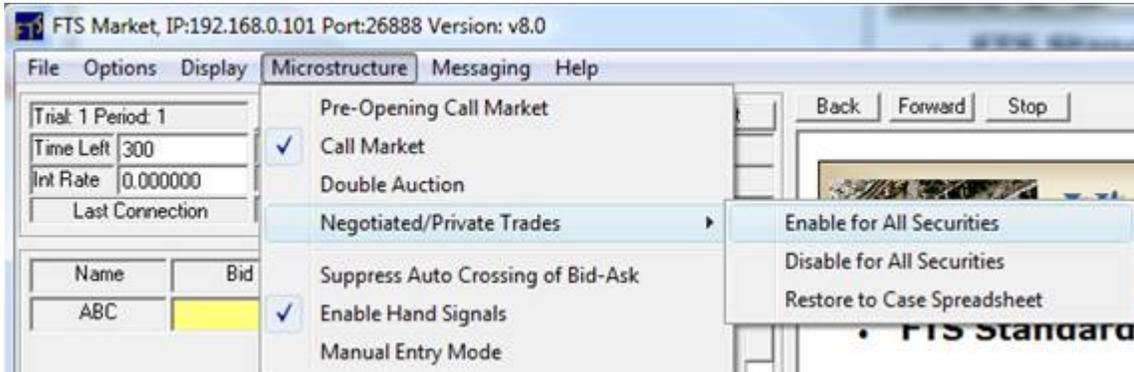
As you can see, this menu item also lets you control other settings:

- If you suppress auto crossing of bids and asks, then if a student enters a bid greater than the ask, it will not be crossed, instead, both will be shown until someone acts on it.
  - Further note: if the same student enters a bid and ask, and the bid exceeds the ask, it will not be crossed, irrespective of the menu setting.
- You can enable or disable hand signals. This is useful if you want to slow down the trading
- If you select Manual Entry mode, then every entry has to be typed in afresh. For example, suppose a student enters a bid of 12 for 50 units. This stays in the entry area, and so to re-enter the bid, the numbers do not have to be typed again, the student can simply keep clicking the "Submit Bid" button. In manual entry mode, the bid would have to be retyped before any button could be clicked.
- You can also enable or disable privately negotiated trades; this can only be done prior to the start of the period.

Returning to the call market, if you select it, you will be asked to confirm that you want to run a call market:
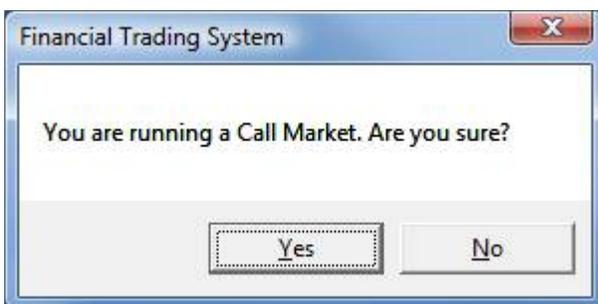
After confirmation, the trader displays change to the following:

Security Name	Price				Volume				Position	Last	
ABC									100.		

So the Bid and Ask columns have been replaced by "Price" and "Volume" columns.

Trading proceeds as follows. Students enter bids and asks. These are displayed in the book though you can suppress the display from the Display menu of the FTS Market.

If there is a cross, then the trade takes place, and the price and volume traded are reported to everyone. If you hide the display of the book, no one sees the process of bidding and asking, so information is only transmitted when a trade takes place.

In a **pre-opening** call market, the same process takes place, except that at the end of the call market, the outstanding bids and asks are used to start off the double auction; you have to manually select the double auction; this way, you can run multiple rounds of the pre-opening call market prior to the double auction.