Zero-Intelligence Trader Lab

Name_____, Section_____

The Market

Experimental economics has a long tradition of placing human subjects in simulated double auction markets. The results of the double-auction experiments consistently support that human agents can achieve high levels of market efficiency quickly (through few rounds of trading) and even in relatively thin markets (few buyers and sellers). Gode and Sunder (1993) conducted experiments comparing human agents with zero-intelligence artificial agents in double-auction markets and found that the zero-intelligence agents can lead to high levels of market efficiency even given their random decision making. They concluded that rationality is not a necessary assumption for the market to achieve efficiency and that the market institution provides the first order effect on market efficiency.

Gode and Sunder (1993) implement a simplified order book mechanism in a double auction market. As described in their paper: "We made three choices to simplify our implementation of the double auction. Each bid, ask, and transaction was valid for a single unit. A transaction canceled any unaccepted bids and offers. Finally, when a bid and ask crossed, the transaction price was equal to the earlier of the two." (p. 122). Thus there are four possible current states of the order book: a) no best ask (lowest ask price) nor a best bid (highest bid price); b) a best ask and no best bid; c) no best ask but a best bid; or d) both a best ask and best bid. Note that the best ask will be greater than the best bid in case (d) and that there is at most one best ask and one best bid on the order book at any time.

In the zero-intelligence trader model, buyers are randomly assigned buyer values between zero and maxBuyerValue. Sellers are randomly assigned seller costs between zero and maxSellerCost. In each tick of the clock, either a buyer or seller is randomly selected. A buyer randomly forms a bid price between his buyer value and 0 (ZI-C), or between maxBuyerValue and 0 (ZI-U). A seller randomly forms an ask price between his seller cost and maxBuyerValue (ZI-C) or between 0 and the maxBuyerValue (ZI-U). A selected buyer then compares his bid to the current state of the order book. If his bid is above the best ask, he accepts the best ask and the buyer and the seller who made the best ask then trade at the best ask. The order book is then emptied. If the buyer's bid is below the best ask (or there is no best ask) and there is no best bid, it becomes the best bid. If the buyer's bid is below the best ask (or there is no best ask) and above the best bid, it replaces the best bid. If the buyer's bid is below the best bid, his bid is ignored. Analogous actions occur if the selected trader is a seller by comparing their randomly formed ask to the current order book. If the selected seller makes an ask below the best bid, a trade occurs with the best bid at the best bid price. After selecting a buyer or seller, if a trade occurred then the involved buyers and sellers are removed from the market since each buyer and seller can only trade one unit. The process continues unitl maxNumberOfTrades is reached.

The model implements the zero-intelligence constrained (ZI-C) traders from Gode and Sunder. The ZI-C traders cannot make a trade that will yield a negative profit, i.e., buyers cannot buy at a price higher than their buyer value and sellers cannot sell for a price below their seller cost.

Lab Exercise

Model 1:

1. Go to http://mcbridme.sba.muohio.edu/ace/labs
2. Select the ZI-Trader model and run it in your web browser.
3. For the first exercise, use the default setup of the model. To insure that you have the defaults, press the “reset” button in the model.
4. Complete 5 runs of the simulation. For each run:
   a. click “setup”
   b. record the predicted equilibrium price and quantity by hovering the cursor over the intersection of the demand and supply curves.
   c. click “go” to run the simulation for 2000 ticks
   d. record volume, average price, standard deviation of price, and market efficiency
5. While running the simulations take note of the following:

a. How do transaction prices and quantity emerge?
b. Do the observed transaction prices and volumes approach the predicted values? How quickly?

Model 1: Simulation Results

Obs	Price	Qty	Vol	Avg Price	Std Dev	Eff
1						
2						
3						
4						
5						

Model 2:
1. For the second exercise, set the number of sellers to 100 and leave the number of buyers at 50.
2. Complete 5 runs of the simulation. For each run:
   a. click “setup”
   b. record the predicted equilibrium price and quantity by hovering the cursor over the intersection of the demand and supply curves.
   c. click “go” to run the simulation for 2000 ticks
   d. record volume, average price, standard deviation of price, and market efficiency
3. While running the simulations take note of the following:
   a. How do transaction prices and quantity emerge?
   b. Do the observed transaction prices and volumes approach the predicted values? How quickly? Do the observed prices tend to stay (above, below, or the same as) the predicted price?

Model 2: Simulation Results

Obs	Price	Qty	Vol	Avg Price	Std Dev	Eff
1						
2						
3						
4						
5						

Questions to ponder:

1. What level of market efficiency arises? Are the results fully efficient? What might lead to the result your finding? How might this relate to the “matching” issue in our classroom experiments?
2. How much dispersion is there in the transaction prices? Are they centered around the average price or is the distribution flatter? multiple peaks?
3. How is it possible for a transaction price to be above the demand curve or below the supply curve? Is the model wrong?
4. Does having a different number of buyers and sellers cause the efficiency of the ZI-traders to go up or down? What might explain the result you found?