

CSS 610 Homework #2: Supply and demand with zero-intelligence (ZI) traders

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Assignment: Do one of the following or your own variation on the basic ZI code

1. Instantiate a population of 50 buyers and 50 sellers and run the trading process to equilibrium (i.e., no more trades are possible. Discuss why there is run-to-run variation. Finally, alter the population from run to run and make many runs of the model. Determine how much of the overall variability in outcomes is due to the population changing versus 'natural' run-to-run variation.

- First run with 50 buyers and sellers.

```

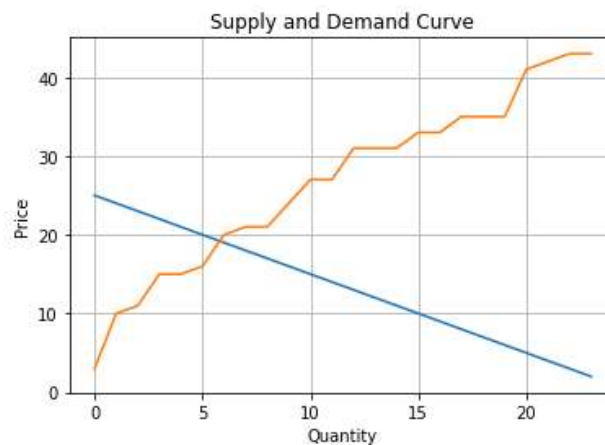
Python 3.12.4 | packaged by Anaconda, Inc. | (main, Jun 18 2024, 15:03:56) [MSC v.1929 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 8.25.0 -- An enhanced Interactive Python.

In [1]: runfile('C:/Users/petit/.spyder-py3/CSS610-AgentBasedModelingSimulation-Spring2025/Python/ZI.py', wdir='C:/
Users/petit/.spyder-py3/CSS610-AgentBasedModelingSimulation-Spring2025/Python')
Generating Agents...
buyers
[21, 18, 44, 44, 47, 3, 32, 8, 23, 18, 10, 6, 28, 26, 29, 28, 50, 4, 25, 8, 43, 33, 1, 11, 32, 1, 20, 24, 20, 13,
12, 39, 6, 19, 45, 32, 14, 36, 16, 38, 48, 44, 28, 18, 10, 4, 30, 49, 19, 46]
sellers
[12, 38, 13, 20, 50, 35, 29, 22, 34, 41, 47, 44, 7, 28, 31, 35, 16, 33, 20, 30, 43, 2, 32, 20, 30, 1, 45, 19, 25,
34, 22, 6, 25, 7, 14, 33, 7, 41, 16, 19, 20, 23, 8, 28, 32, 46, 13, 41, 19, 43]
Executing first run...
Model execution time (HH:MM:SS) is: 0:00:00
Quantity traded = 24
The average price = 26.791666666666668 and the s.d. is 10.999921085575519
Number of trades in this run = 24
Quantities for this trade [25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2]
Prices for this trade [3, 10, 11, 15, 15, 16, 20, 21, 21, 24, 27, 27, 31, 31, 31, 33, 33, 35, 35, 35, 41, 42, 43,
43]

```

Plot a histogram of the prices paid over a single run. Draw the actual supply and demand curves for the fixed population.

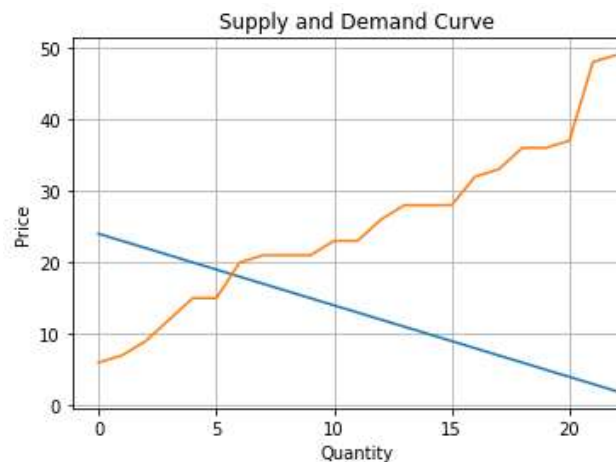


- Second run with same agents but different realization of trading process to equilibrium:

```

Executing second run...
Model execution time (HH:MM:SS) is: 0:00:00
Quantity traded = 23
The average price = 24.956521739130434 and the s.d. is 11.464418530807718
Number of trades in this run = 33
Quantities for this trade [24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2]
Prices for this trade [6, 7, 9, 12, 15, 15, 20, 21, 21, 21, 23, 23, 26, 28, 28, 28, 32, 33, 36, 36, 37, 48, 49]
2,23,24.956521739130434,11.464418530807718

```



The first run had one more trade than the second run. The average price for the first run is approximately \$2 more than the second run. The standard deviation in the second run was greater than the first run. The max price was \$43 for the first run compared to \$49 for the second run. Min price is \$3 for the first run and lower than the min price \$6 for the second run.

- Runs for 35 times with same agents, there is no call to `thisRun.generateAgents()` but permitting the agent pairings to vary from run to run. Summarize the variability in price and quantity statistics over these many runs.

The quantity traded in each run varied but stayed between 21 and 27 trades. The average price also varied from run to run but was within \$22.83 and \$28.92. The variance in average price was 1.738 and the variance in quantity traded was 2.005. The variance in standard deviation of 0.936 indicates that there is little variability in prices.

The run-to-run variation is caused by randomness incorporated in the asking price, bidding price, and selection of which agent to trade with in this model. The initial prices randomly generated to alter outcomes for each run.

- Runs for 35 times and Allows for Changing Agent

The quantity traded in each run varied but stayed between 18 and 29 trades. The average price also varied from run to run but was within \$20.13 and \$28.29. The variance in average price was 3.51 and the variance in quantity traded was 9.26. The variance in standard deviation of 1.29.

Higher standard deviations suggest more variability in prices and quantity traded with changing agent population. The compared to the previous run where we kept the same agent population, there is much more run-to-run variation. Running ANOVA test on the two outputs, the f-statistic

0.0744 is small and with a p-value of 0.786 – not statistically significant with threshold alpha of 10%. Meaning there is differences between previous run using same 35 agent versus this run of creating 35 new instances of agent is more due to 'natural' run-to' run chance than the introduction of new agents to ZI model.

Code Repository

<https://github.com/lydiateinfalt/CSS610-AgentBasedModelingSimulation-Spring2025>