

Small World Lab

Name _____, Section _____

The Market

This model implements bilateral exchange in small world networks based on the model described by Wilhite (2001). Wilhite studied the impact of network formation on key elements of the trade process: search, negotiation, and exchange. In particular, he focused on the implication of small world networks on trade. In a small world network, an agent is only a few connections away from any other agent. Small world networks were popularized in the game "six degrees of Kevin Bacon" where participants try to link any one actor/actress to another actor/actress through other actors/actresses that they have shared a movie with (starting with Kevin Bacon).

This model is an adaptation of a model developed by Allen Wilhite (2001). In Wilhite's model, 500 agents are placed in one of four network structures (described below). Each agent is given a random endowment of each of two goods. Good 1 can only be held and traded in integer units while good two is perfectly divisible. Each agent has a Cobb-Douglas utility function dependent on the two goods and all trades must satisfy their budget constraint. Prices are specified in terms of amount of good 2 paid for a unit of good 1.

In each round of the model, every agent (in random order) is given the opportunity to search among all agents to which he has a network connection to find the best agent to trade with. The pair of agents then trade using bilateral exchange until further trade would not improve both agent's welfare. Rounds of trading continue until a round occurs with no trades.

The four network structures Wilhite implements are:

Global: All agents are connected to every other agents. Thus each agent is able to trade with every other agent.

Locally Disconnected: The agents are split into distinct groups. Agents are connected only to other agents in their group. Thus each agent can only trade with agents in their group and no trade takes place across groups.

Locally Connected: The agents are split into distinct groups as in the locally disconnected network. The groups are then arranged in a circle and each group overlaps its neighboring groups by sharing one member. Thus every group has two agents who are common to different adjacent groups. The common agents can trade with members of either group while the rest of the members of a group can only trade within the group.

Small World: The agents are formed into a locally connected network. Then a small number of agents are randomly selected to connect with agents in other groups. There are two restrictions on these crossover connections. First, a crossover agent cannot be one of the common traders shared between adjacent groups. Second, the new connection cannot connect two groups who already have a common agent.

This model implements the major features of Wilhite's model. The number of agents is smaller due to limitations in clearly graphing the alternative network structures. In addition, this model allows you to specify experiments with alternative values for key parameters: number of agents, number of groups, number of crossover agents, and the maximum endowment that can be randomly set for each good for each agent.

Lab Exercise

1. Go to <http://mcbridme.sba.muohio.edu/ace/labs>
2. You can either use the online version of the simulation or choose to download and install Netlogo, then download the Wilhite Netlogo model to run it.
3. In the exercise, you will run 4 different versions of the model, each five times. The settings for each model are listed above their respective tables below.
4. Complete 5 runs of the simulation. For each run:
 - a. click “setup”
 - b. click “go” to run the simulation. The simulation stops automatically when equilibrium has been reached.
 - c. record the requested data
5. While running the simulations take note of the following:
 - a. How do the networks differ across the four models visually.
 - b. Do the observed average price approach the predicted value? How quickly?

Model 1: Global Network

Num-agents=50, num-groups=1, endowment=1000, network=global, num-crossovers doesn't matter

Run	Predicted Price	Global Avg Price	Global Std Dev	Searches	Total Trades	Rounds
1						
2						
3						
4						
5						
Avg.						

Model 2: Locally Disconnected Network

Num-agents=50, num-groups=5, endowment=1000, network=local disconnect, num-crossovers doesn't matter

Run	Predicted Price	Global Avg Price	Global Std Dev	Searches	Total Trades	Rounds
1						
2						
3						
4						
5						
Avg.						

Model 3: Locally Connected Network

Num-agents=50, num-groups=5, endowment=1000, network=local connect, num-crossovers doesn't matter

Run	Predicted Price	Global Avg Price	Global Std Dev	Searches	Total Trades	Rounds
1						
2						
3						
4						
5						
Avg.						

Model 4: Small World Network

**Num-agents=50, num-groups=5, endowment=1000,
network=small world, num-crossovers=2**

Run	Predicted Price	Global Avg Price	Global Std Dev	Searches	Total Trades	Rounds
1						
2						
3						
4						
5						
Avg.						

Questions to ponder:

1. How would you describe the differences between the four network structures in terms of ability to trade?
2. How close did each network structure come to the predicted equilibrium price? How much dispersion occurred in the prices? (std dev)?
3. Which model came the closest in predicting price? Which had the smallest std deviation? Which had the fewest searches? The fewest trades? Converged most quickly?
4. What criteria could be used to determine which network structure is the “best” for promoting efficient trade among people?