

Assignment 1: The agent-based CLUSTER (Clustered Location of Urban Services, Transport, and Economic Resources) model

The main objectives of this assignment are to help students:

1. understand retail location choice in the context of supply chains
2. understand the mechanism of the evolution of retail clusters
3. understand the impact of economic and geographical factors on retail clusters

Empirical studies have found that hierarchical distributions of economic activities and resources exist in almost every city, region, and nation (such as the US carpet production industry concentrated in Dalton, Georgia and the Italian textile industry in Prato, Italy). The mechanism of the clustering of industries and service as well its impact on is not yet sufficiently examined. The economic division of the Metropolitan Council started a pilot project to understand how individual business owners choose locations and the policy factors that impact the distribution of retailers. You are hired as an economic analyst to study the effects of possible policy initiatives or alternative decision-making assumptions in retail distribution. Parts of your responsibility are to provide theoretical groundings on the mechanism of clustering and to explore the implications of the following changes in economic policy and individual retailers' decision-making assumptions.

The changes of the assumptions include: (1) products' shipping cost, (2) number of suppliers, (3) number of customers, (4) geographical factors (such as distance scaling parameter).

The theory underlying the CLUSTER model is described in the following paper:

Huang A, Levinson D, 2011, "Why retailers cluster: an agent model of location choice on supply chains" *Environment and Planning B: Planning and Design* 38(1) 82 – 94
<http://nexus.umn.edu/Papers/RetailPaper.pdf>

The simulation tool: CLUSTER <http://street.umn.edu/Cluster/CLUSTER.html>

This agent-based model is employed to study retail location choice in a market of homogeneous goods and a market of complementary goods. On a circle comprised of discrete locales, retailers play a non-cooperative game by choosing locales to maximize profits which are impacted by their distance to consumers and to suppliers. A brief in-class demonstration will be given to familiarize you with the underlying model of CLUSTER.

Your Tasks

In completing this project, you must fulfill the following tasks:

Task 1: Understand the simulator

Run simulations under default values as well as one alternate set of scenarios (by sliding the scroll bars of some variables):

- distance scaling parameter: 1.0
- number of suppliers: 5
- number of retailers: 10
- retail sales price of product x (\$): 2.5
- suppliers' price of product x (\$): 1.5
- individual consumer demand on product: 20

Task 2: Run the simulation under different economic scenarios of interest.

You can adjust values of parameters to reflect different assumptions. Copy the graphic output for your report. (You can use copy screen function of you computer). Compare the retail distribution patterns with the result of the base case.

Task 3: Submit a memo reporting your findings.

Recommended outline for your report is as the follow:

- 1) Problem statement
- 2) Methodology
 - Simulation (briefly describe CLUSTER and report your results from Task 1)
 - Analysis methodology (stating what and why you choose a particular method)
- 3) Evaluation and Analysis
- 4) Results and Findings
- 5) Discussion of limitations
- 6) Conclusion

The report must be no more than 2500 words. Electronic submission required in PDF.