Agent-Based Computational Approach to the Evolution of Market Structure

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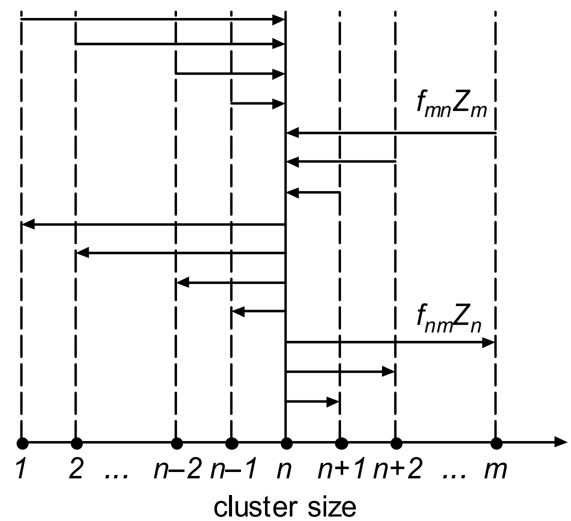
A cluster theory based mathematical model was developed and used to simulate the dynamics of a system composed of a large number of interacting agents-clusters with different size. The case of a system formed by a constant total number of economic units (agents) in metastable (partial) equilibrium was considered. Figure shows how n-sized cluster can increase or decrease. The arrow beginning from size $n(m)$ and ending at size $m(n)$ symbolizes the quantity $f_{nm}Z_n(t)$ ($f_{mn}Z_m(t)$) which gives the number of $n \rightarrow m$ ($m \rightarrow n$) transitions per unit time, where $f_{nm(mn)}$ and $Z_{n(m)}(t)$ denote transformation frequencies and quantity of clusters of size $n(m)$ at time t, respectively. The master equation for a closed system of M units is a set of ordinary differential equations of first order, and in the case of $|n\text{-}m|=1$ (the Szilard model), characteristic especially for the processes occurring at the early (nucleation) and late (ageing) stages of such transformations, the non-stationary solution was numerically found for different high values of M. The size effect on the formation of the groups (clusters) of agents was particularly elucidated, and we proved that the fragmentation and coagulation rates of groups of agents definitely depend on the size of the group. The average group (cluster) size problem was also solved for different values of M, and the process of relaxation of the system has been studied. The role of attachment probability in "quantifying" economic growth has been described. Comparisons between this model and other kinetic models of random growing networks and herding phenomena will be reported.



Schematic presentation of the possible changes in the n-sized cluster.

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