

Modelling spatial market dynamics with retail agents

Mark Birkin and Alison Heppenstall

University of Leeds
a.j.heppenstall@leeds.ac.uk

The power of agent-based modelling (ABM), when integrated with other AI-based and conventional approaches, can be greatly enhanced. The resulting hybrid systems offer a flexible modelling environment that exploits the benefits of the component methods. In particular, the ABM paradigm can be used to explore and understand systems that are governed by complex, non-linear relationships and self-organisation.

In earlier research, the authors have described an agent-based model of retail behaviour in which customer transactions are simulated using spatial interaction models (Heppenstall et al., 2005, *Trans. in GIS*, 9, p.35). The model has been used to simulate processes such as the diffusion of price changes through a retail network, and the interdependence of pricing behaviour between competing retail chains (Heppenstall et al., 2006, *J. Artif. Societies & Soc. Simulation*, 9).

In the research which is now presented, we draw an insight from an established method which explores the behaviour of retail provision when customer transactions are simulated by a spatial interaction model, but in which structural change is driven by a simple equilibrium-seeking mechanism. Established methods have provided useful insights into retail patterns under equilibrium-seeking behaviour, but have done relatively little to enrich our understanding of the dynamic processes and decisions from which change arises. Through the combination of these approaches, it is suggested that a much richer model architecture is possible, in which interacting retail agents produce a spatially heterogeneous distribution of supply. This structure brings together coevolution in the economic and geographical variables (price and provision) through a dynamic model of competition amongst agents.

A series of numerical experiments are introduced to demonstrate how the use of agents can introduce more behaviour. The simulations are embedded in a real local retail environment. We evaluate the extent to which this work can be considered to present an improved understanding of this system.