Socio-dynamic discrete choice: Theory and application

Dugundji, E.R.

Publication date
2013

ABSTRACT

Suppose you have the possibility to choose to adopt one of a number of discrete behaviors or to choose to buy one of a number of different products. Moreover, suppose the choice is multi-dimensional or more generally, that there are common unobserved attributes of the choice alternatives. A classic approach to statistical prediction in such a situation given an observed sample of decision makers in a population is the nested logit model, pioneered by Ben-Akiva (1973) in the context of transportation demand modeling and generalized by McFadden (1978) in the context of residential choice modeling. Now suppose your choice to adopt a discrete behavior or buy a discrete product is influenced by what choices the members of your social network make, or by your perception of percentages of your neighbors, social peers and/or colleagues making these choices, or your perception of such general segments of the population. Brock and Durlauf (2006) have proposed such a variant of the nested logit model, noting that, "*There has yet to be any analysis of (such) models ... when self-consistency is imposed on the expected group choice percentages. Such an analysis should provide a number of interesting results.*" It is one of the aims of this thesis to fill this gap. After a brief review of fundamentals in Part I, in Part II of the dissertation, we present theoretical results for mean field, steady state corner solutions in parameter space derived drawing on techniques from the mathematics of dynamical systems and bifurcation theory. These analytical results are subsequently used as a benchmark for empirical work. In Part III, we present an initial application of a socio-dynamic binary logit model to transportation mode choice using survey data collected by the Hague Consulting Group on intercity travel in the Netherlands over a sweep of parameter space with abstract classes of networks. Then, we present an empirical application of a socio-dynamic nested logit model to transportation mode choice using pseudo-panel microdata collected by the Municipality of Amsterdam Agency for Traffic, Transport and Infrastructure in the greater Amsterdam region with various hypothesized social-spatial networks. In both case studies, we combine econometric estimation with computational techniques from the field of multi-agent based simulation, assuming exogenous influence networks. In Part IV, we further explore econometric issues, estimating more complex discrete choice models. We conclude highlighting limitations of the present study and provide recommendations for future work. The appendices provide supplementary theoretical results and a selective overview of various modeling considerations that could be relevant in an extension to residential choice with endogenous networks.