Computing topological entropy in Cournot duopoly games with homogeneous and heterogeneous players

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Abstract

The main aim of this paper is to analyse the dynamics of nonlinear discrete-time maps generated by duopoly games in which players are homogeneous and/or heterogeneous and the reaction functions are non-monotonic and asymmetric. We also present the computation of topological entropy of these nonlinear Cournot models. In the particular case of nave expectations, the model takes the form of a anti-triangular two-dimensional map, T(x,y)=(f(y),g(x)). It is interesting to observe that the second iterate of the map T transforms into a simple skew-product map, that is, T(x,y)=(F(x),G(y)), which allow us to study the latter and conclude about the former. We analyze the behavior of this map, from stable to chaotic Nash equilibrium, compute and discuss the entropy by using tools from symbolic dynamics and tensor products. In the other case is considered a game with boundedly rational and adaptive players. There are always multiple equilibria, Neimark-Saker and period-doubling bifurcations, and the significance of the Nash equilibria is pointed out. The dynamics and the topological entropy are mainly analysed by numerical simulations.