The stability of nonstationary Markov strategies in a dynamic resource game with heterogeneous discounting

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In this paper, we study the stability of nonstationary Markov strategies in a two-player dynamic resource game with heterogeneous discount factors and infinite horizon, originally developed by Levhari and Mirman [1]. It is well known that this game has a unique Markov-perfect equilibrium (MPE) in stationary strategies that is also globally stable. We analyze several consequences of enlarging the strategy spaces of the players to include Markov nonstationary strategies. In particular, we prove the following: 1. The MPE in stationary strategies is the limit of a sequence of nonstationary equilibria for the finite horizon game as the horizon tends to infinity; 2. The MPE in stationary strategies is also an MPE in nonstationary strategies, but it is both locally and globally unstable; 3. There are two asymptotic equilibria where the consumption of one player converges to zero and the consumption of the other player is maximized in the limit. Both of these equilibria are saddle-path stable; and 4. There is a continuum of asymptotic equilibria where the consumption of both players converge to zero and the limiting stock is maximized, which are locally stable. However, these equilibria may not satisfy a terminal condition for dynamic problems with unbounded payoffs, which is both necessary and sufficient for optimality, as has been recently shown by Wiszniewska-Matyszkiel [2], and Wiszniewska-Matyszkiel and Singh [3].

Referencias

[1] Levhari D. and Mirman L.J. (1980) "The Great Fish War: An example using a dynamic Cournot-Nash solution," Bell Journal of Economics, 11(1):322-334.

[2] Wiszniewska-Matyszkiel A. (2011) "On the terminal condition for the Bellman equation for dynamic optimization with an infinite horizon," Applied Mathematics Letters, 24, 943–949.

[3] Wiszniewska-Matyszkiel A. and Singh R. (2021) "Necessity of the terminal condition in the infinite horizon dynamic optimization problems with unbounded payoff," Automatica, 123,109332.