

A Great Fish War Model with Asymmetric Players

Michèle Breton, GERAD, HEC Montréal

Michel Yevenunye Keoula, GERAD, HEC Montréal

The great fish war model of Levhari and Mirman (1980) is a parsimonious framework that has been extensively used for analyzing open-access problems in fisheries. A well known result is that the non-cooperative setting yields a prisoner's dilemma type of result, and that coordination of international fisheries is Pareto-improving, raising the question of stability of international coalitions. As it is the case in environmental games or in the cartel theory literature, stable large membership in international coalitions cannot be obtained without the help of additional mechanisms, such as sequential moves, transfers, or farsightedness.

The farsightedness assumption in a coalitional game acknowledges the fact that a deviation from a single player will lead to the formation of another coalition structure, as the result of possibly successive moves of her rivals in order to improve their payoffs. As shown in Breton and Keoula (2010), this behavioral assumption, an alternative to the traditional Nash conjectures, permits to overcome the puzzle of small coalitions in fishery games by allowing the formation and stability of large coalitions up to the size of the grand coalition.

This paper extends the work of Breton and Keoula (2010) by assuming asymmetry among the players participating in the fishery. Since, in the Great Fish War model, the players are characterized by their discount factor, this amounts to allowing every player to have a discount factor of her own. A prominent example of asymmetry in the discount factor has been analyzed in a two-player setting by Munro (1990), referring to the Pacific Islands Tuna Fishery, where some of the islands found themselves in a much more favorable position for the access to the resource and therefore placed greater emphasis on future returns. Another motivation, provided by Lohoues (2006) refers to big multinational firms with better alternative investment opportunities than local fishermen.

In this paper, we derive analytically the equilibrium payoffs of this coalitional game with asymmetrical players. We also investigate the impact of the asymmetry assumption on the extreme schemes of cooperative and non-cooperative equilibria, and more specifically on the Pareto-effectiveness of the cooperative solution. We then proceed to the computation of Nash and farsighted stable coalitions for the partial coordination scheme, in the case where players are divided into two groups (high and low discount factors).