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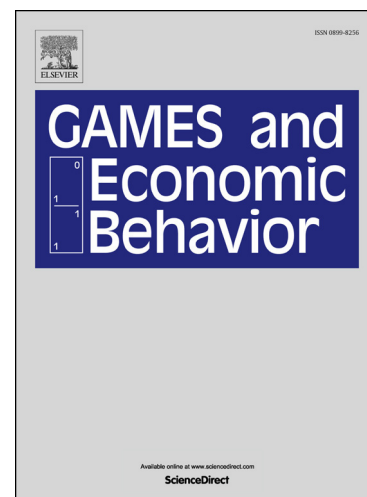
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A universal construction generating potential games

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Abstract

Strategic games are considered where each player's total utility is the sum of local utilities obtained from the use of certain "facilities." All players using a facility obtain the same utility therefrom, which may depend on the identities of users and on their behavior. If a "trimness" condition is satisfied by every facility, then the game admits an exact potential; conversely, if a facility is not trim, adding it to a potential game may destroy that property. In both congestion games and games with structured utilities, all facilities are trim. Under additional assumptions the potential attains its maximum, which is a Nash equilibrium of the game.

Journal of Economic Literature Classification: C72.

Key words: Potential game; Congestion game; Game with structured utilities; Game of social interactions; Additive aggregation

1 Introduction

When Monderer and Shapley (1996) introduced the notion of a *potential game*, the main example they had in mind were Rosenthal's (1973) *congestion games*. Their Theorems 3.1 and 3.2 showed that a finite game admits an exact potential if and only if it can be represented as a congestion game (the sufficiency part was implicit in Rosenthal's reasoning). An alternative, more transparent proof was given in Voorneveld et al. (1999, Theorem 3.3).

Kukushkin (2007) introduced *games with structured utilities*, in a sense, "dual" to congestion games; the players there do not choose *which* facilities to use, only *how* to use facilities from a fixed list. The idea of such a structure of utility functions can be traced back to Germeier and Vatel' (1974), although the local utilities in that paper were aggregated with the minimum function. Theorem 5 from Kukushkin (2007) showed that a strategic game admits an exact potential if and only if it can be represented as a game with structured utilities.

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