

Single-valued core selection and aggregate-monotonic solutions to equitable cost allocation

ABSTRACT

Single-valued core selection, equity and aggregate monotonicity are desirable properties for cost allocation but offer challenges to develop suitable allocation methods to satisfy. This paper attempts to develop a new solution approach to meeting these properties. The idea is first to identify the critical value of the grand total cost for non-empty core, using an LP to maximize the grand cost subject to individual and group rationality conditions. The critical grand cost is then allocated by any single-valued core allocation methods available such as the nucleolus and its variants. The non-critical grand cost values are allocated simply by scaling up or down from the critical case so as to ensure aggregate-monotonicity. In addition, a new core allocation method is proposed for the critical case, based on prorating the best and worse costs that are feasible bounds for each player in the grand cooperation. Existence of such proration fractions is proved along with lower and upper bounds identified explicitly, which indicates some sense of equity. The new method is found to be desirable for the cases with two or three players, and more research is being conducted for general cases of more than three players.

Keyword: Aggregate-monotonicity; Core selection; Cost allocation; Critical cost allocation; Equitable allocation; Single-valued solution